ELECTRICAL REVIEW

[ILLUSTRATED.]

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Thury Dynamo.

This machine, of which we give an illustration on this page, differs in many essential particulars from the majority of dynamos in use in this country.

Most of our machines are designed to have a high speed of rotation 1,200 to 1,400 revolutions per minute; whereas, the intention of the inventor of this machine has been to reduce the speed as much as possible. In the table published by the manufacturers a machine of the type H_4, adapted to operate 1,000 16 candle-power lamps, makes only 250 revolutions of the armature per minute.

The makers claim that for mechanical reasons there is a decided advantage in the slow speed. Such machines are especially adapted for use for ship lighting, or where the power is derived from fixed shafting, etc. Mechanically considered the machine consists of a multipolar inductor within which rotates a drum armature, upon which is wound rectangular coils, which are wholly on the surface of the drum.

The connection between the coils being on the ends of the drum, but very little of the wire is idle. Six pair of collecting brushes are employed. The machine is really three small machines combined, and may be so employed if desired.

Is the Phonographic Locmanaud a Rival of the Telephone?

AN INTERESTING CONTRIBUTION TO THE HISTORY OF ELECTRIC INVENTIONS—A NEW CLAIMANT FOR TELEPHONIC HONORS.

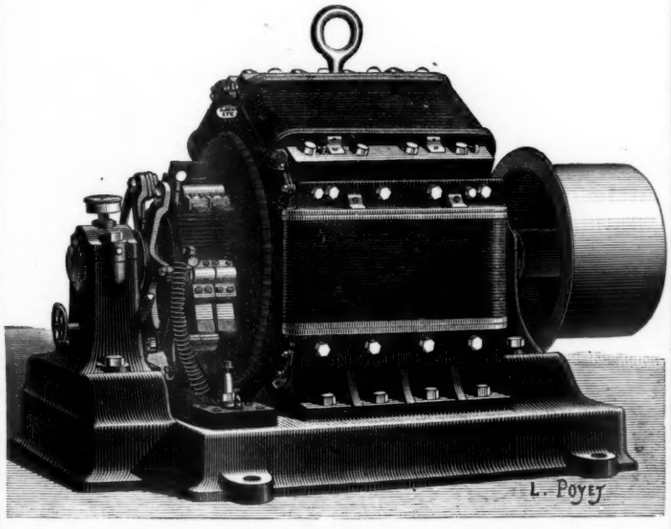
On the 18th of May, Mr. Henry C. Strong, of Chicago, filed with the Register of Wills at Washington, D. C, a petition for letters of administration to the estate of Lancelot H. Everett, supposed to be dead. The petitioner states that Lancelot H. Everett left New Orleans in 1867, to go to England. Since his departure he has not been heard from, and it is supposed he perished in a shipwreck. Everett had certain models filed in the Patent Office on June 27, 1866. He left no known heirs or friends except the petitioner and his brother, John B. Strong, late of Texas, both of whom were well known to the deceased. The petitioner claims that the models are exposed to view, and in danger, and are liable to become the means of depriving the United States of most important evidence in the pending telephone suit against the American Bell Telephone Company. He prays that in order to preserve and perpetuate the testimony that the models be placed in his custody, subject to the orders of the officers of the United States.

These models possess an interesting and unique history. The examiners in the Patent Office were at a loss where to class them, and we can't find it in our heart of hearts to blame them; nor do we think our readers will. The models went to "Signals" first. After being knocked about from one class to another, they turned up in "Philosophical Apparatus," where they remained until Philosopher Henry C. Strong, in his researches, discovered them, and then followed the action stated above.

What are these models? Look on the illustrations on the two following pages and you will see them, and it is here and now predicted you never saw their like before, and the supposed philosopher of the REVIEW, who endeavored to discover from the patents what the inventor was seeking, would gently but firmly state at this point that he hopes he will never see their like again.

THE FIRST PATENT.

In the year 1863, on the 17th day of November, Mr. Lancelot Hope Everett, of New Orleans, received a patent for an improvement in acoustic telegraphs, called a "Phonographic Locmanaud," and what these two words imply is shown in Figs. 1 and 2, we trust to the satisfaction of every observer. Notwithstanding his dipping into Greek and Latin to secure a comprehensive



THE THURY DYNAMO—A. DE MEURON & CUENOD, GENEVA.

title ("Locmanaud" being derived from *locutus*, to speak; *manus*, the hand; *auditum*, to hear) the inventor admits that while "Phonographic Locmanaud" means a machine that creates, conveys and communicates intelligent sounds through the hands and speaks to the internal sense of hearing, it was necessary that the acoustic trumpets of the outer ear, the finger and thumb tips, and copper wires and battery, should be implied "rather than disturb the euphony of the name." Tastes differ as to what constitutes euphony! Mr. Everett's invention was intended for creating, conveying and communicating intelligence by means of similar and dissimilar intensities of sound, which separately and combined are made to represent the different letters of the alphabet, the various Arabic notations, and other valuations, according to certain phonic formulæ, each one of which is engraved on marble, for the use of the deaf and dumb blind, and tinted of various colors for those who can see. Another important and somewhat startling use of the locmanaud is in enunciating and conveying sermons from a pulpit to a deaf and dumb audience. This is effected by copper wires centered in the "facial incus" of the battery and diverging fan-like toward the assembly—so many hearers, so many wires—the ends of which are held by the index-finger and thumb tips; or the ends being armed with small metallic nipples, they are inserted into the acoustic trumpet of the external ear.

The clergyman evokes the different phonic formulæ at the key end of the battery, and the whole audience simultaneously receive, hear, arrange and understand. When the full advantage of this use of the locmanaud sweeps over the minds of the ministers afflicted with sleepy congregations, there will come a demand for them, with batteries fully charged and running over, that will astonish Mr. Everett's administrator, and electrify into the most devout attention the one-time sleepy senses of the pew-holders. The marble locmanaud is different from the ministerial locmanaud and is intended for the use of two deaf and dumb persons, as it stands upon the table between them. The auditor places himself in contact with the one side of the locmanaud, and receives the symbolic sounds (these symbols are sounded by the battery), which are evoked by the operator on the opposite side. As the various formulæ of letters are sounded by the operator, so are they conveyed by the locmanaud and received by the auditor, and by him combined into letters, words and sentences; and thus the conversation begins and progresses, until the operator, having finished his talk, he in turn places himself in contact with the locmanaud and becomes auditor. Communication between parties at a distance from each other—and right here is, no doubt, where Administrator Strong, in his buoyant, sanguine way, sees the Bell telephone antedated—is effected by a bisection, shown at *c* in Fig. 1, and connecting the two sections with long copper wires. The parlor locmanaud, Fig. 1, is constructed as follows: It is pyramidal in form, having two faces—an anterior and a posterior—upon which the phonic orders and symbols and phonic formulæ of letters of the alphabet, Arabic notations, and valuations are engraved, so that the deaf and blind, the dumb and blind, may be instructed by it; and they are colored of various tints, that they may the more easily be memorized by the deaf and dumb who can see. There are also two lateral faces, upon one of which is engraved an explanation of the nature of sound, and upon the other some of the uses of the machine.

Upon the marble base A the pedestal B, with the acouglottic battery, is placed and mounted. The several parts of the battery are named after the ossicula of the anatomical ear.

C is the incus. It forms the *point d'appui* upon which the different intensities of sound are elicited from the non-metallic atoms of the atmosphere.

D is the malleus. It is made to compress the atoms of the air suddenly upon the facial incus and evoke the silence therefrom.

E is a hole drilled in the center of the facial malleus, called the "phonic fossa." It regulates the phonic units and directs them through the incus.

F is the tympanum, which generates the various intensities of sound by striking the facial malleus and phonic fossa upon the facial incus from various distances therefrom.

G is the key by means of which the operator strikes off all phonic formulæ classed under the different orders of sound.

H is the orbicular. It receives the various sounds from the opposite side and inducts them into the nervous papillæ of the index-finger tips, one of which must be pressed upon it by the auditor, who thus receives them from the operator.

I is the stapes. It is mounted over the incus to give strength and support to the tympanum and key.

K is a metallic rim, which encircles the edge of the incus and retains it in its place. The incus is composed of solid copper, which, for practical purposes, ought to be bell-metal. The malleus is of iron, the orbicular also, and should be polished. The tympanum is of steel; the stapes of copper, with projecting feet screwed upon the pedestal.

L is the left diatonic staff. It has five bars, from each one of which a different order of sound proceeds, and each order is represented by a different symbol. The bars are placed at different distances from the facial incus, and also from one another, and together their sounds express all the letters of the alphabet.

To explain the working, one instance is given: The first bar, No. 1, is placed one-eighth of an inch from the facial incus, and creates the vowel order of sounds, M. Its symbol is a circular cavity O painted green. One such symbol expresses the phonic formula of the letter A. Two such symbols express the letter E, and so on to Y, thus:

	Symbols.	Sounded.		Phonic Formula of
1 such	O	"	=	A
2 "	OO	"	=	E
3 "	OOO	"	=	I
4 "	OOOO	"	=	O
5 "	OOOOO	"	=	U
"	OOOOOO	"	=	Y

These symbols are sounded continuously from the first bar as quick as one, one, two, one, two, three, etc , can be counted.

In the clergyman's locmanaud the incus is of much larger caliber, and the acouglottic battery doubled.

The chief claim of this patent is for "two phonographic locmanauds mounted by acouglottic batteries, so that persons who are deaf and dumb and blind— arising either from physical defects or from length of distances —may hear and hold converse together by means of these locmanauds and copper wires attached thereto." This was in 1863.

THE SECOND PATENT.

One would think one patent like that just described would satisfy the most ambitious inventor, and he should be thankful that his life had been spared; but Mr. Everett was not content, and in 1868, on the 24th of March, another patent on an "Improvement in acoustic telegraphing" was received by him—and now he is dead! Those of our readers who have got thus far with us, will be pleased to be informed that if they understand Mr. Everett's first patent, the second one, five years later, is easy to comprehend from the illustrations on page 3. Fig. 3 represents the acoustic battery, and Fig. 4 sectional views of same. In this patent Mr. Everett does not refer to the deaf and dumb and blind, but claims as his invention "an acoustic battery for telegraphing, a machine which creates and modulates sounds, that, when arranged and sounded under specific symbolic formulæ, they are made to represent and express all the letters of the English alphabet and all Arabic notations, and when thus evoked into existence, the machine reflects these sounds and transmits them through naked wire, buried in the land or water, to their destination, where they impart their various interpretations with such distinctness and order to the auditor who receives them, as to become the most important and efficient commissioners of intelligence."

Was Mr. Lancelot Hope Everett the first inventor of the telephone?

Prof. Joseph Henry and the Magnetic Telegraph.

A MEMORIAL ADDRESS DELIVERED BY EDWARD N. DICKERSON, LL.D., PRESENTING TO PRINCETON COLLEGE A TABLET DESIGNED TO COMMEMORATE THE CONTRIBUTIONS TO THE ELECTRIC TELEGRAPH OF JOSEPH HENRY.

Mr. President and Gentlemen, Trustees of the College of New Jersey:

The pleasing but sad duty has been assigned to me of presenting to you this memorial tablet of the beloved master, who once shed the luster of his genius over this ancient seat of learning, and once attracted to its classic shades, allured by his great reputation, pilgrims from all lands, to drink from the living font of knowledge, ever replenished and refreshed by his ceaseless contributions.

I commit this monument to your tender care. May it ever remain enshrined in this beautiful temple. May its presence encourage those, and the successors of those, to whom he delivered his torch of science, ablaze with a light which had penetrated to the farthest ends of the earth, to tend that sacred flame; so that when they shall transmit it to their successors it shall still be borne high aloft in the upper atmosphere of pure truth with still increasing luster—a guiding beacon to the wayfarer, wandering and astray in the gloomy valley of ignorance—those deep defiles, where the shadows seem ever darkening by contrast with the brightening mountain tops illumined by the rising sun of knowledge.

May it inspire the ingenuous youth, who in the thronging years of the future shall gather about these altars, to search the character and achievements of the grand master, that they may be taught by him how to study, how to think, how to work, how to live, and how to die.

May it continue to remind those who annually are attracted here to witness the evidences of the growth of knowledge, as they are exhibited in the commencement seasons, that once this college was honored by the ministrations of Joseph Henry, an American, who, with means created almost wholly by himself, rivaled the achievements of the greatest scientists of the Old World, working with the resources of nobly-endowed institutions and encouraged by the bounty of kings, and for years was ever a leader in the vigorous attack upon the arcana of nature, made by the champions of science in the early years of this century.

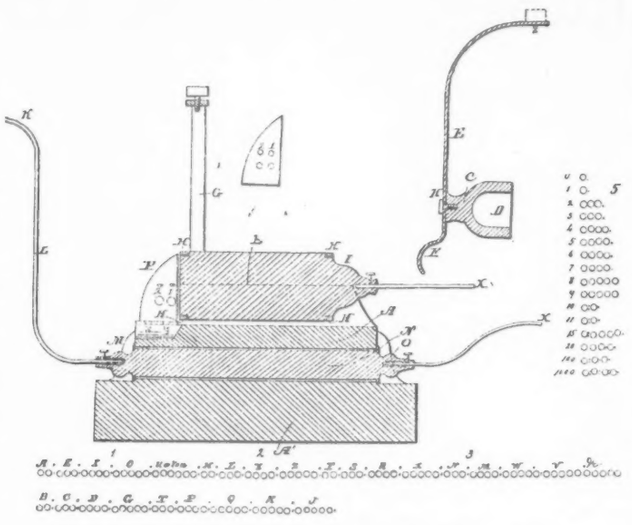


FIG. 2.—SECTIONAL VIEWS OF THE PHONOGRAPHIC LOCMANAUD.

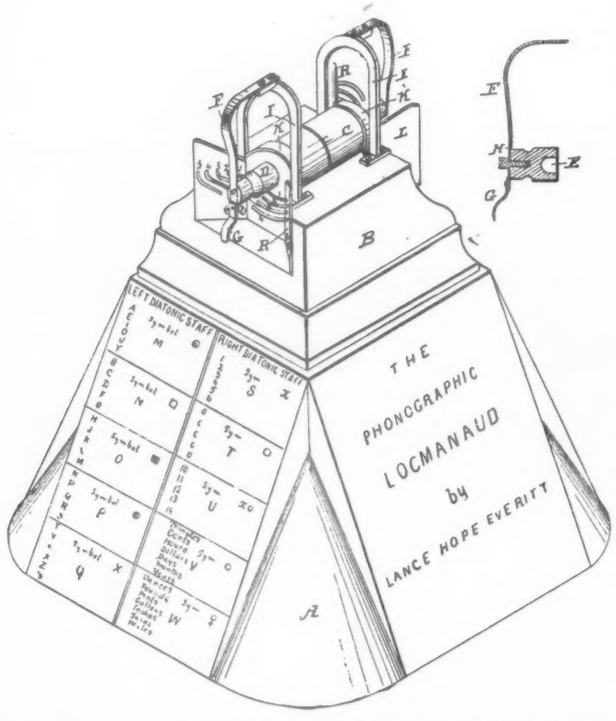


FIG. 1.—MODEL OF AN INVENTION ALLEGED TO COMPRISE THE PRINCIPLES OF THE TELEPHONE—PATENTED IN 1863.

For those of us who enjoyed the happiness of knowing him well, and loving him dearly, no sculptured marble is needed to stir our hearts, or keep fresh in our memories that noble presence, which at once charmed and satisfied our senses. Nor, if the chisel of the artist were guided by the genius that once inspired Phidias, would it be capable of fixing upon dull, cold marble more than one of the almost infinite variety of expressions revealing to the world without the exalted being within.

But to those who have never seen him, or having seen him have never known him, and to those who shall come after us, it will be something to look upon this marble, and inspired by the thoughts he uttered, and the deeds he did, contemplate its calm expression, and imagine what must have been the living man.

In the year 1839, nearly half a century ago, brought here as a student, I first saw Professor Henry. I remember it well—the time, the place, and the surroundings. Boyish imagination had pictured the great discoverer as a venerable man, bowed down with the toil of years, bearing the furrows, with which overtasked nature revenges herself, traced upon his brow: such a person, perhaps the artist has presented to us in the familiar picture of Humboldt in his library.

How different the reality! In the maturity of a perfect manhood he stood:

"A combination, and a form indeed,
Where every god did seem to set his seat,
To give the world assurance of a man."

His clear and delicate complexion, flushed with perfect health, bloomed with hues that maidenhood might envy. Upon his splendid front, neither time, nor corroding care, nor blear-eyed envy, had written a wrinkle, or left a cloud; it was fair and pure as monumental alabaster. His erect and noble form, firmly and gracefully poised, would have afforded to an artist an ideal model for an Apollo. The joy of conflict and of triumph beamed from his countenance—a conflict in which, for years, he had struggled with the phantoms that guard the hidden treasures of nature, and had ever been victorious. And above all, surmounting all, infinite charity and gentleness—like the charity and gentleness of a loving mother for her erring children.

To him the youthful student bowed down in profound admiration. To him, and to his memory, for nearly fifty years, he has clung with ever-increasing love and affection. And now that seven years have passed away since death severed the bond strengthened by a life-time of intimacy, he recurs with fondest memories to the many happy occasions when it was his good fortune to spend hours in sweet and instructive converse with this gifted mortal, to whom the whole book of nature was an open volume, out of which he ever read lessons of wisdom, and beauty, and truth.

As Professor Henry appeared in 1839, so he continued till 1847, with but little change in the physical man—only that change which, like the changes in the early autumn, lightly touched with tints of exquisite beauty the mature growth of springtime and summer; and then, with extreme reluctance, he departed from Princeton, called by his country to lay down the arms with which, as a soldier in the ranks, he had been waging his warfare against ignorance, and take command of the intellectual forces to be summoned and organized by him in the same glorious cause.

Born in the dying moments of the eighteenth century, his age was marked by the numbers denoting the years of the nineteenth. Like the century, with whose growth his growth kept pace, he had developed with almost unexampled rapidity; and at the age of thirty-two, when he took his chair here, although "he was but a youth, and ruddy, and of a fair countenance," and was armed only with a simple sling of his own construction, and pebbles from the brook of nature, he was equal to the trained warriors of maturer growth and superior armor, waging war against the Goliah that guarded the unexplored regions of nature's secrets; and like the great King of Israel, after the brunt of the battle was over, he came to be leader of the hosts, who once had been tending only a "few sheep in the wilderness."

Let us contemplate for a moment the intellectual stature of our departed teacher, considered merely as an investigator of natural laws, and measured by the standard established by the intellectual world.

It is in the order of nature that the intermittent progress of humanity is made under the guidance of gifted men, appearing from time to time, who push forward the outposts of truth, whether in morals or physics, calling upon their fellow-men to hasten and occupy the newly-conquered fields. The names of such men are few, and are written upon the rolls of fame. Their glory belongs to no nation, but to all mankind. Sometimes simultaneously and in different parts of the world two such appear, who seem to have been cast in similar moulds, lest, perchance, one might die or fail, and progress stand still. Such men are Henry and Faraday, whose intellects were moulded with the same capacities, and who worked out their tasks in the same spirit. If either one had died before his work was done, the other was capable of doing it; and, in fact, both, in many cases, struck out the truth, each unconscious that the twin thought had been born in the brain of the other.

To those devoted friends and admirers of Faraday, who delight in singing his well-earned praises, and who best comprehend his achievements, it seems that his discovery that electricity might be produced from magnetism was his grandest result. Upon it depends many of the most important applications of electricity to the uses of man; and in the near future many more are coming. Tyndall, the successor of Faraday, does not restrain his enthusiasm when he contemplates

this achievement. "I cannot help thinking," says he, "while I dwell upon them, that this discovery of magneto-electricity is the greatest experimental result ever obtained by an investigator. It is the Mont Blanc of Faraday's own achievements. He always worked at great elevations, but higher than this he never subsequently attained."

Let us accept the standard, and apply it to Henry; let the achievement measure the power of the man.

In November, 1831, Faraday read before the Royal Society his memorable paper "On the Evolution of Electricity from Magnetism," illustrated by drawings of the apparatus, in which Fig. 1 is the compound "spool," discovered by Henry in 1828, and which Faraday used in making his discovery. No publication referring to this paper had reached this country till April, 1832, when a vague reference, made to it in the *Annals of Philosophy*, was seen by Henry, which led to his publication of July, in *Silliman's Journal*, where he gave a full account of this great discovery, made by himself before he heard of Faraday's work, which, when compared with Faraday's paper of November, exhibits Faraday's experiment for solving the problem. When he wrote his paper, Henry, mislead by the imperfect statement in the *Annals of Philosophy*, supposed that his experiment had differed from Faraday's, but was undeceived when the full publication reached him. In 1831, a teacher in the Albany Academy was very remote from London, and the Royal Society.

In that same year, and in the same few weeks, Faraday first, and Henry after him, independently made the discovery of magneto-electricity; "the greatest experimental result ever obtained by an investigator," in the opinion of Tyndall.

In the same field, and during the same years, were the other great scientists of the world studying the same subject: Ampere, Arago, Oersted, Davy, and a host of others; but these two did it, and not the others, and Henry did it by devices of his own invention, unaided by anything which Faraday had discovered or produced, while Faraday used Henry's electro-magnet in performing his most important experiment.

The towering heights which were scaled by the daring spirit of Faraday from the East, were at the same time surmounted from the West by our own countryman. Both were climbing from opposite sides at the same time, and neither was conscious of the other's efforts till both stood, face to face, upon the summit. Had Henry been furnished with the corps of trained mountain guides and Alpine stocks, such as attended Faraday in his ascent, perhaps his foot would have first trodden the peak, and Prof. Tyndall's song of triumph have been addressed to him.

But when we compare Henry with Faraday, who is the acknowledged unit of comparison, the accidental conditions under which both existed and worked must be known, or justice cannot be done. Electrical science was the field to which both spontaneously directed their studies. Its mysteries at once excited curiosity, and baffled research. Its most obvious phenomena had only for a short time been recognized, and everything was to be learned. What they did in that science, not only constitutes the greater part of their claims to reputation as investigators, but is almost the whole of our present knowledge of magneto-cletricity.

But how superior in every respect, except in God-given intellect, was the equipment of Faraday. He was eight years older than his rival. In the year 1813 he was appointed "assistant" in the laboratory of the Royal Institution, under Sir Humphrey Davy, then one of the foremost scientists of the world, who, attracted by Faraday's genius, was directing his studies and forming his mind. At that time Henry was but thirteen years old.

In the next twelve years Faraday was at work, with all the resources of the Royal Institution, under the instruction of the great Davy, in acquiring the knowledge with which he was armed when he began his original investigations; while Henry, during that same period, was struggling unaided for such education as might be obtained from the scanty resources of a country town; and with that proud independence, ever so marked a feature of his character, was supporting himself by teaching to others a part of that which he was learning himself.

In 1825 Faraday had so improved his great opportunities that, at the age of thirty-four, he was appointed "director of the laboratory" of the Royal Institution, where everything that science could suggest, and money procure, was at his command in aid of research. Henry was then a private tutor in a distinguished family at Albany; studying mathematics in hours when his duties to his pupils had ceased, and when other young men might have thought they had earned the right to relaxation and enjoyment.

In 1824, before Henry ever had in his hands any instruments for research in electricity, Faraday, thus trained and equipped, began his attack upon the problem of magneto electricity and failed; and in 1830 it was not yet solved.

The discoveries of deductive science need no apparatus. They are made and matured in the brain; and to record them is the only physical incident to their existence or development. Plato would have looked with disgust and contempt upon a laboratory; and would have scorned the suggestion that time, or place, or physical surroundings, could affect the workings of his mind, or influence his deductions. But the new philosophy, which has changed the face of the world, is of no such ethereal nature. It is born in observation of physical things; it is nurtured upon experiments that cost money, and time, and labor; its maturity is in perfected arts, and in things to be seen, and handled, and enjoyed by the senses; its end is to subordinate the blind forces of nature the uses of man—to mitigate the ills, and multiply the joys of life. They who are the servants of this philosophy, must be provided with materials with which to reproduce, in minature, the conditions that exist in nature in grander proportions, or they cannot ask the questions whose answers they are seeking; and, other things being equal, he who is well provided with all these needful things, has an immense advantage over another who lacks them.

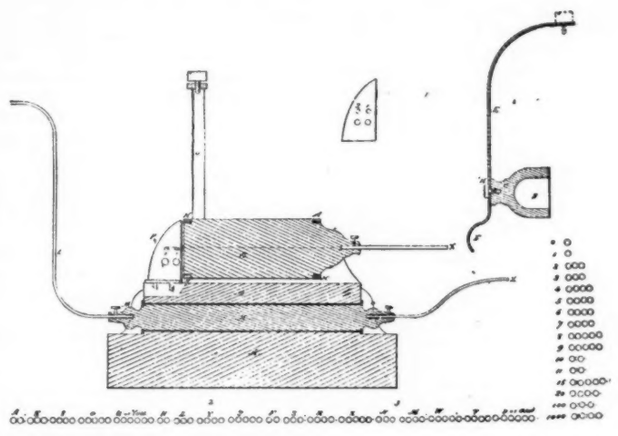


Fig. 4.—Sectional Views.

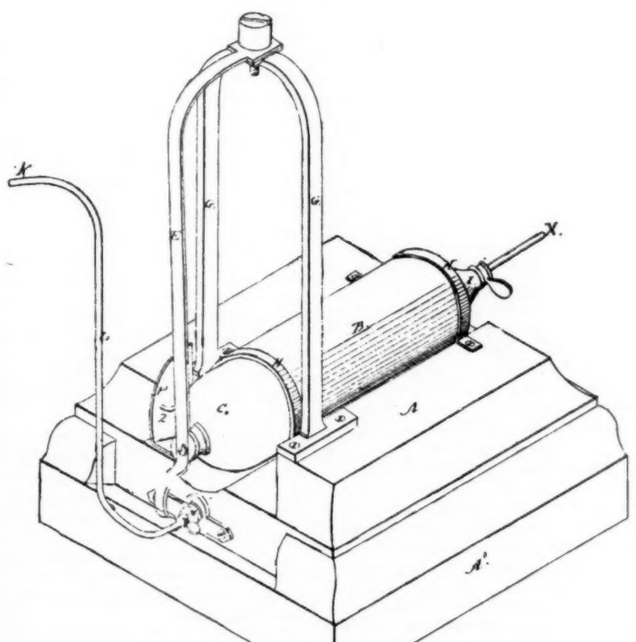


Fig. 3.—Mr. Everett's Second Improvement in Acoustic Telegraphing—Patented in 1868.

For thirteen years Faraday has been pursuing his investigations amply supplied, and was in the full career of successful experiment when, in 1826, his great rival first looked upon the course over which he was to run; and even then Henry had to depend upon the meagre facilities of the Albany Academy, and the voluntary assistance of an appreciative physician, Dr. Philip Ten Eyck, of Albany—a name to be held in grateful remembrance by all who feel a pride in the achievements of the great scientist, whose early efforts were assisted, and whose hopes encouraged, by this enlightened friend.

With such a beginning as this, who could expect that the young aspirant for fame should ever overtake his great leader in the friendly contest? And when he did overtake him, and in some important investigations surpass him, who shall deny that Henry, as a physical investigator, was the equal of him above whom it is conceded no other man has risen in this century!

In still further pursuing his researches into the subtle phenomena of electricity, Henry made, here in Princeton, another capital discovery, this time in advance of Faraday, which forms an important element in the science of electricity. It is to be found detailed in any school book, under the name of "Henry's Coils." His wonderfully elaborate investigations will be remembered by the students of that day; as it was conducted in part in the open air. Wires stretched across the campus, in front and in rear of Nassau Hall, were the means by which the questioner was cross-examining nature, and wresting from her reluctant grasp her hidden secrets. At that time telegraph wires did not exist; and those fine lines traced across the sky, excited the liveliest interest in the students, whose fantastic guesses as to their significance were the cause of much pleasantry in the idle hours.

In the course of these investigations it was also the good fortune of our scientist to first discover the very curious phenomenon of "self induction," as it is now called, which plays so important a part in the creation and use of electric currents on wires, sometimes injuriously and some imes beneficially. Without the knowledge of its laws no duplex or quadruplex telegraph could be practically operated; with that knowledge it can be neutralized when it is injurious, and made available when useful. The brilliant spark which follows the pulling of the pendant, attached to an electric lighter for inflaming a gas jet, now in common use, is one of the valuable practical applications of this principle so discovered.

In contemplating the discoveries of the scientist there are two aspects in which they present themselves. In one view we consider merely the difficulty of the achievement; in the other, the value of the result to mankind. The first view is obvious when the thing is done; the other is to be reserved for a future day, when all the consequences have followed the original cause. The first view is that which measures the power of the man—just as the lifting of a huge weight by some Hercules exhibits his strength, even though the thing done may be, or may seem to be, useless. The capital discoveries I have named, made by Henry and Faraday, exhibited the giant's strength when they were made, and measured the men who made them. They were found at great depths below the surface, where mental visiou can only penetrate by the aid of lenses, constructed in advance, in accordance with the very laws for whose discovery they are needed—creations of the scientific imagination, and called scientific hypotheses. In such creations Professor Henry was excelled by no man.

Time will not permit even a hasty review of all the scientific labor done by Professor Henry at Princeton during those years when his chief duties were instruction, and when he had only a portion of his time in which to work for mankind and for reputation, and I must be content with a passing glance at a part of it.

Among those wires which were strung across the campus in 1835 was one used for a magnetic telegraph between the professor's home and his laboratory in the Philosophic Hall; and that telegraph line was the first in the world in which the galvanic circuit was completed through the earth—one end of the single wire-circuit terminating in the well at the house, and the other in the earth at the hall. Steinheil, in Munich, in 1837, worked his electric telegraph in the same way by a single line wire, using the earth as part of the circuit over much longer distances, but it was first done in this campus.

Nearly a century earlier our great countryman, Franklin, had drawn from a surcharged thunder-cloud, upon the string of a kite, in a pouring shower of rain, the lightning of heaven, and had demonstrated its identity with the puny spark of an electrical machine; and with that capital experiment his fame is more closely associated than with any other of the great truths he discovered. In these grounds that experiment was amplified, and still further results obtained, by the man for whom the mantle of Franklin had been waiting all those years, and who was the only American whose stature would not have been dwarfed by assuming it.

From the clear, blue sky, with two kites, one above and assisting the other, held by a delicate wire wound on an insulated reel, Professor Henry drew down streams of brilliant sparks, intensified by the self-induction of the wire itself, thus proving the electrical relations of the earth and its envelope. So a child's plaything in the hands of a master reveals the hidden mysteries of the universe.

Away beyond the distant horizon we see at times a quivering illumination of the sky, but hear no thunder. How shall that phenomenon be questioned? Fifty years ago Henry converted the metallic roof of his

(*Continued on page 6.*)

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EDITORIAL ANNOUNCEMENT.

Address all communications and make all Express Money orders, P. O. orders and checks, payable to order of ELECTRICAL REVIEW, P. O. Box 3329, New York.

We invite correspondence from Electricians, Inventors and the Telegraph and Telephone fraternity and those engaged in Electric Lighting on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

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Frank M. Gilley, 54 Equitable Building, Boston, Mass., is our New England representative.

Mr. C. C. Haskins, 118 LaSalle Street, Chicago, Ill, will represent the REVIEW in the West.

Messrs. Wm. Dawson & Sons, 121 Cannon Street, London, England, are our representatives for Great Britain.

NEW YORK, JUNE 5, 1886.

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The case of Ex-examiner Wilber, and his various affidavits, recall the old story of the death of Richard Baxter. That eminent theologian, after a life of continuous sectarian warfare, lay upon his dying bed, when he was visited by several leaders of one faction in the church, who made notes of what they believed to be his final confession of faith and published them in a pamphlet entitled "Last Words of Richard Baxter." But a rival faction gained access to the sick-room, by skillful questioning extracted another statement, waited till the breath had positively left the old man's body, and then published a pamphlet on their side entitled "More Last Words of Richard Baxter." There are doubtless a good many religious controversialists to-day who would be puzzled to know which pamphlet actually contained a summary of the faith in which Richard Baxter died. There is room for a like difference of opinion in the Wilber case, and until the subject can be thoroughly sifted it will be hard to judge whether the deponent told the truth in the affidavit which confesses a crime or in the several affidavits preceding it which declare that there was no crime to confess.

A contribution to the history of the magnetic telegraph is given considerable space in this issue. Probably a great many of our readers will be surprised to know of Prof. Henry's early work with regard to magneto-electricity, and that it was through his inventions and discoveries that Faraday was enabled at last to work out his master-piece. Mr. Edward N. Dickerson, the author, is the best of authority, and handles his subject in his usual able and interesting manner.

The attention of the enterprising electricians of the telephonic fraternity is particularly invited to those early inventions of Lancelot Everett Hope, illustrated and described in the REVIEW. This citizen of New Orleans evidently possessed an original and exploring turn of mind, and while he did not, in our opinion, invent the telephone, he had worked out something similar in the sense that a hobby-horse is similar to Maud S., or Jay-Eye-See. If the expressions that appear in the inventor's description of his "Phonographic Locmanaud" become elements in our already somewhat mixed electrical nomenclature, students of electrical literature will receive fresh cause for discouragement.

The National Carbon Company, of Cleveland, Ohio, is announced as the company formerly known as the Boulton Carbon Company, of that city. In its notice the company states that the change has been made "for the purpose of avoiding annoyances that have arisen by reason of its present name, and because W. H. Boulton is no longer connected with said corporation."

The American Bell Telephone Company has gained another substantial victory in the courts. This company, it will be remembered, brought suit recently against the National Improved Telephone Company, of New Orleans, of which Watson Van Benthuysen is president, and obtained an injunction restraining the latter company from operating its telephones in that city upon the ground that the Bell Company's patent rights were being infringed. Judges Pardee and Billings rendered a decision in favor of the Bell Company, perpetuating the injunction. This was a hard-fought contest, the full particulars of which appeared in the REVIEW at time, and the result is certainly most valuable to the Bell Company, and discouraging to the varied elements that have been so sedulously endeavoring to break down its patents. Another decision in favor of this company was delivered by Judge Wallace, in which Dr. Beckwith, of Elizabeth, N. J., is restrained from using the Meucci invention as being an infringement of the Bell.

The next meeting of the Executive Committee of the National Electric Light Association is to be held June 29th, and, as requested by the chairman in another column, all information concerning all matters relating to the convention in Detroit, August 31st, should be received at that time. This is important, as without such information no definite programme of the work can be arranged. All committees should send word to Chairman DeCamp, and all others who may have matters of interest should promptly communicate with him.

Those earnest and sincere citizens who are continually crying "down with the rates" charged for the rental of telephones, are kindly requested to note this fact: In the *Statesmen's Year Book* figures are given which show that the Government of England operates 27 exchanges, comprising 1,142 subscribers, and the gross annual revenue is £22,600, or nearly $100 each. For exchanges occupying similar territory in this country the average rental per subscriber is $60 per annum. It is fair to presume from this that our telephone rates are not at all extortionate as compared with the rates charged by the English Government, which is supposed to be working in the interest of the people and not for stockholders' dividends, and has no royalties to pay. Either England is making a big profit out of her telephone venture or the rates in the United States are extremely low.

PORTABLE ELECTRIC LIGHTS IN MINES.

The recent report of the English Commission on accidents in mines, states that it has been experimentally proved that a percentage of marsh gas, amounting to five per cent. or even four per cent., with atmospheric air is decidedly explosive; and further, that while half of this proportion is not in itself dangerous and impossible of detection by the ordinary lamp-test, will explode if the air be laden however lightly with fine coal dust.

The commission also express as their opinion that the "safety" lamps of Davy, Clauny and Stevenson have, in a great measure, lost their value in consequence of the currents of air required in the modern practice of ventilation. Portable electric lamps have therefore become a necessity, and considerable attention has lately been given to the production of such a lamp. What is required is a complete battery and lamp with concealed non-get-at able connections (so that the miners can't meddle with them), which will not weigh over three pounds and which will furnish a three candle light for six hours, the length of an ordinary working shift.

De la Rue chloride of silver battery has been employed to some extent, but as in the case of all primary batteries the current derived is a decreasing quantity.

Mr. J. W. Swan, of England, has produced a lamp and battery weighing 1¾ lbs., and consists of 7 accumulator cells, the electrodes of which are of lead wire. This battery will give a current of .14 ampere at 2 volts for 12 hours. The candle-power of the lamp being approximately 2½ candles and gradually falling to 2 candles.

Mr. J. Pitkine, of London, lately showed a portable lamp and battery consisting of 4 accumulator cells contained within a teak box, and so arranged as to be coupled in pairs and operated by means of a switch. The device complete weighed 6 lbs., and will operate a 2 candle-power lamp for 10 hours.

As yet no device has been made which fulfills the required conditions. We commend the subject to our ingenious electrical friends.

ELECTRICAL LABORATORIES.

The New York *Sun* in a timely article, recently called attention to the frauds perpetrated by so-called "Telegraphic Institutes and Electrical Schools" on would be students. In a word, showing the majority of them to be barefaced frauds—and designed merely to absorb the money and time of those often the least able to pay either, and without being of the slightest benefit.

That such "schools" (?) continue to exist and thrive is sufficient evidence that there is a demand for the facilities and class of information they purport to afford and impart. Most of the European countries have recognized this want and have subscribed liberally and established laboratories where the principles of electricity can be learned practically, by the use of apparatus, as well as studied theoretically.

These schools for the most part are entirely free, or but a very small fee is charged, often barely sufficient to cover the wear and tear of the apparatus.

This country has no such institution. Stevens' Institute, Cornell University, Columbia College School of Mines, and the Sheffield School of Yale, although to be highly commended, are not for the masses, and do not furnish the required facilities What is wanted, is a national institute where instruments can be standardized and means obtained for undertaking researches which are necessarily of an unremunerative nature, but which are of vast public importance. Branches of such an institution could be established in the important cities and the collective work could but be of value—at the same time, the instruction imparted would educate a class of men who would be valuable in the public service, should the telegraph eventually come under government control.

Failing Government aid in such an enterprise, there are doubtless many of our wealthy citizens who would be glad to aid in founding such an institution.

The matter is worthy of serious consideration by our readers, and it is hoped that a movement will shortly be made in the direction indicated

ELECTRICAL NEWS OF THE WEST

Down in Indiana there are native poets. One of these breaks out thus:

In the land o' the Hoosier the telephone
As a matter o' fact is clean dead gone,
But the capital now is a lively town
For all other trades in the streets is done,
And in my business they'se quite a stir,
Says the Indianapolis cordwainer.

They'se nuthin' like luther to take the track
An' keep yer bisness f'm gettin' slack.
I ain't a keerin' for cause we're back
To whar A. Graham struck his fust tack.
The shoe-make business has tuck a stir,
Says the gentleman Hoosier cordwainer.

Them poles and wires the town runs through,
The 'thorities ort n'to allowed 'em so;
But sense they're standin' jest leave mine go,
My customers needs 'em for hitchin' to;
For the shoe-make business has tuck a stir,
Says the gentleman journeyman cordwainer.

From La Porte, Ind., comes the statement that a company has been formed to publish the *Weekly Telegrapher*, devoted to the interests of the fraternity of operators.

A sharp dodge in the pool room business here has been the statement confidentially whispered in the ears of victims that "there is a confidential party in the employ of the Baltimore and Ohio Telegraph Co., who enables us to get advance items on races and the like, and a party has, when required, been pointed out as the individual." The plot has been exploded effectually by showing, first, that the Baltimore and Ohio had no office where the mysterious gentleman was assumed to office; secondly, that the party pointed out was not in the employ of the Baltimore and Ohio; and thirdly, that no one had been able to make any strike through information obtained through this human mystery.

One of our criminal judges is a wag. A note supposed to be in his handwriting was handed the County Commissioners the other day, which reads as follows:

Messrs. County Commissioners: Will it be quite convenient to you to furnish us with half a dozen bull's eye lanterns, for use when juries are kept after dark? They cannot feel around and find a verdict when there is no light.

The electric light in the court rooms is promptly shut down when the clock says six. The gas has been turned off at the meter, and on a recent occasion a jury detained after the dynamo man's supper time had to either hunt lamps or "find the verdict in the dark.

The Cumberland Telephone and Telegraph Company, at its last meeting held in Henderson, Ky., elected Messrs. Jos. H. Thompson, J. H. Fall and James E. Caldwell, of Nashville, as directors; the rest of the Board consisting of Messrs. E W. Cole, I. T. Rhea, O. F. Noel, Wm. Duncan, E P. Huston and James Compton.

The Board then elected O. Noel president; John Lenihan, secretary; Ida May Toon, assistant; and Leland Hume, treasurer.

During the year past this company has done much in improving and adding to its plants in Tennessee. Nashville and Memphis are now claimed to be first-class, while the former of these exchanges claims to be the most extensive, and to give the best service of any in the United States, population considered.

Two hundred and thirty-eight miles of wires in cables have just been run from the central office to First street, in Edgefield. The cables used are those of the Standard Underground Cable Company, Waring patents. These were laid under the supervision of F. E. Degenhardt, who is the resident representative of the Standard Company at Chicago. The same company has just closed a contract with the Baltimore and Ohio Telegraph Company for about three-quarters of a mile of fifteen number fourteen B. w. g. conductors for Chicago underground work.

Speaking of conductors and cables, and all that sort of thing, brings to mind an anecdote of the drawing in of a Day's Kerite cable the other day, which was the largest—cable, not yarn—ever drawn into a conduit;

and for that matter there were two of them, containing 90 conductors each, of No. 16 B.W.G. six-thirty seconds insulation. As usual there was a crowd, and one of those wiseacres from the rural districts confidentially informed an old insurance man who was making all sorts of inquiries, that this was a fire hose, and "they was a-goin' to fill a receivervoir, down t' the Board o' Trade," he guessed. The size of the blessed thing did certainly give it the appearance of a section of hose, such as we bald-headed chaps used to pump through with the old button machine.

The Jenny people have placed outside their office on Monroe street, a very pretty model of their tower, some twelve or more feet high. It is so pretty that every man, woman and child feels an instinctive desire to fondle and caress it. "Hands off the bright work" only egges people on, and the surest way in the world to test one's curiosity is to label an article "don't touch." There are thousands of people who will open a door and peep in where it says "no admittance," who never would think of it otherwise. As the tower was constantly being tarnished by passers by, the boys procured a three-inch induction coil, a single cell of battery, and made connection to the tower on one side and a gas pipe ground on the other. There isn't enough to hurt, but those who touch it, are quite chary about touching it again. There is a moral to this, however, for electric light people. In the case of the tower, the ground is a dry stone pavement, the initial force of the battery only one volt, and yet nobody is desirous of taking the induced current continuously. If that kind of a current will work its way down through a human organism to earth *via* a dry stone, what would a first class dynamo current do under like circumstances? Still there are people who say they have taken the entire current of a sixty-light arc machine which was capable of maintaining sixty-two three thousand candle-power lamps; but they invariably add "ours is a low current machine;" which remark might be supplemented by "that is certainly not true of your talking machine."

The Merchants' Electric Illuminating and Power Company, of Galesburg, Ill., was incorporated last week. Capital stock $20,000. R. H. Whiting, Howard Knowles, J. K. Mitchell, incorporators

An interview with a Milwaukee vessel agent the other day brought up the question of cheap telegraphy, and incidentally the history of the Chicago and Milwaukee Telegraph Company. The company was purely a Milwaukee enterprise, and grew out of the unsatisfactory course of the Western Union Company in the handling of the business as well as the tolls, which were looked upon by the Board of Trade boys as exorbitant—25 and 2 being the rate for a distance of 85 miles. "Why," said the gentleman, "messages filed at the Chicago end of the line early in the morning frequently failed to reach us until late in the afternoon, and sometimes not until the day following. Petitions and remonstrances apparently made the matter worse.

"One day an order was posted in the Western Union office, at Milwaukee, announcing that the word 'collect' on the end of a message would be charged for. That was the straw that broke down the last bit of forbearance and we decided to submit no longer."

The matter was talked over, and the cost of construction—not including the right of way into Chicago—was found to be less than $15,000. The company was organized and the funds subscribed in less than ten minutes. "We came near having the life choked out of us by the Chicago Council, however," but by accident the company obtained a lease of the poles of the old Bell Telephone Company, and "came to town." Soon as the line was in working order the company advertised a rate of ten cents between the two cities, and tackled business in earnest.

The first year a dividend of 50 per cent. on the stock was declared, and the second showed a dividend balance of 60 per cent. The line has been in operation for six years, and is to-day one of the best paying pieces of property in the West.

The telephone and telegraph boys and girls throughout the country have done nobly in keeping out of the late labor troubles. It was one of those cases where one could see exactly as well a little way back. In a conflict between capital and labor the one party knows, and the other sooner or later learns, that capital never suffers from hunger, and a full stomach is a stubborn bulwark, from behind the protection of which coaxing may entice the owner to where threats cannot drive him.

Col. Lynch, broker, 146 La Salle street, gives the following valuations of telephone stocks:

Chicago	$350 @ $360
Central Union	40 @ 45
Michigan	64 @ 66
Iowa Union	15 @ 18
Great Southern	25 @ 27
Great Southern, Script, 90 cents on the dollar.	
Colorado	18 @ 20
Rocky Mountain Bell	40 @ 45
Missouri and Kansas	53 @ 55
Missouri and Kansas, Script, 53 cents on the dollar.	
United	15 @ 17
Cumberland	65 @ 70
Wisconsin	107 @ 109
Bell of Missouri	147 @ 150

CHICAGO, May 31, 1886.

BOSTON ELECTRICAL NEWS.

It is sometimes supposed that the placing of different incandescent lamps in the same circuit gives an opportunity for a comparison of their relative values and efficiencies. There was recently in a certain office a multiple of incandescent lamps on an arc light circuit. One of the members of the office, a representative of a rival lamp, wished to have one placed over his desk, making no account of the fact that his lamp required less volts than the other. When placed in circuit it gave a much better and whiter light and was much admired, but its life was short.

Tests with the Brush multiple series cutout at the station of the Brush Electric Light Company, of Boston, have been very successful. The lamps have already shown a life of 800 hours, and are still burning.

The quality and whiteness of two lights can be compared by examining, not the intensity of the shadows, for in that way the relative amounts of light may be estimated, but by the color of the shadows. Shut nearly all the daylight from a room and hold a pencil so that the two shadows will close together on a white background. If the light is not as white as daylight the shadow will be of a bluish color, depth of which is greater in the proportion that the light examined is yellow.

The T. Z. R. wires are having a large sale. The first placed in the New York Aequeduct is still in use. The factory is making upwards of two miles per day, with orders for 200 miles ahead.

A bill will probably be favorably reported to the Massachusetts Legislature relative to the extension of the charters of the gas companies of the State, permitting them to distribute electric current. The broad powers granted will open the field of the distributing of power by electric motors or the furnishing of current to home railroads for the purpose of propulsion.

The Sun Company, of Woburn, have made arrangements to enlarge their plant to supply their multiple series distributor without delay. The Sun system has been adopted by the Brush Company, of Boston, who are ready to supply incandescent lamps anywhere from their lines.

H. McL. Harding, the general manager of the Sprague system for New England, has associated with him Mr. P. A. Dowd, one of the leading electricians in Boston; Mr. F. J. Sawyer, formerly with the Edison Company; Mr. E. W. Kellogg, of Lynn: A. T. Starkey and J. Forboro.

If white light (sunlight, etc.) be passed through a triangular-shaped piece of glass, a number of bands of colors will be seen, varying from red, yellow, green, to blue and violet. In the case of sunlight the bands are crossed with innumerable black lines. If it were not for the absorption of the blue rays by the earth's atmosphere, the sun would appear of a bluish tinge instead of a red color. Sunlight, then, is not pure white, as the red and yellow rays predominate. With gaslight the blue and violet rays are almost wanting, the color being extremely yellow compared with sunlight. If the prism colors of the arc light be examined, the blue and violet rays are in proper proportion to give white light sometimes with a slight bluish tinge. The incandescent light at a high temperature gives perhaps the purest white; unless the filament be at a high incandescence, the light may have a yellow cast. Now, exclude light from a room, and allow the colored bands from a prism, placed in the path of a ray of light, to fall upon a white surface. In these bands of colored light hold different objects of red, green and blue colors. It will be seen that the red looks red while in the red light, that elsewhere it looks black. In the same way the green and blue objects appear black unless placed in their own colors. As gas light is deficient in blue and violet rays, those colors cannot be accurately matched in that light. The electric light has no such disadvantage, and all objects have their true appearance as regards color.

Now that the committee of the Legislature appointed to examine into the practicability of electric motors has returned, it is possible to find out their own impression and the opinions of the legislative body at large. At Greenville, N. J. owing to an insufficient amount of current, the test of the Enos system was not shown to its best advantage. The car was run on the 200 feet of level track, while since the time of the visit a further portion of the track containing a grade of 300 feet, and a curve of 50 feet radius has been regularly traversed.

The following day, the party were present at a trial on the 34th st. branch of the Elevated Railroad in New York. The road has a grade of 70 feet to the mile. The car weighing 27,000 lbs. and containing about 70 passengers, the maximum number, was run up and down the grade, stopping and starting promptly at any point. Members who were at the start doubtful of the success of electric motors, expressed themselves as thoroughly satisfied.

BOSTON, MASS., June 2.

PHILADELPHIA ELECTRICAL NEWS

The electrical railroad, which has been under construction on Ridge avenue in this city for some time, has been completed, and a successful test was made of it last week. The motor used is the Bidwell.

A delegation of Buffalo's city officials was in Philadelphia last week examining the workings of our patrol system. Philadelphia is noted for her fine patrol system, and many cities are adopting similar ones.

The firm of Tathem Brothers are making extensive improvements in their facilities for covering cables, and although their capacity now is quite large I am informed with their new equipments they will be able to turn out a much larger amount.

Councils will decide on Thursday what shall be done with the overhead wires. The different companies have so far been successful in "staving off" any decided action in the matter, but now since the public have raised its voice it looks as if there will be something done in the case.

The Philadelphia Dynamic Company, who are the owners of the Edco system of electric lighting, report business very brisk. They are shipping a great many of their motors to Europe.

James W. Queen & Co., who are, perhaps, the largest importers of fine electrical instruments in this country, report the receipt of some very fine instruments of entirely new design and capable of very minute work.

The Electrical Committee of Councils held one of the stormiest of sessions it has ever known, on Friday last. The subject discussed was the general ordinance regulating the laying and constructing of underground conduits, wires and cables in this city. While Chairman Graham, Mr. Hoffman, Mr. Freeman and President Lawrence, of Common Councils, took a bold stand in favor of putting the wires underground, there were other members of the committee who did not seem to care to have the overhead wires go. Among the representatives of the electric companies present were Henry M. Bentley, president of the Philadelphia Bell Telephone Company, Samuel B. Huey, counsel for the same company, and Superintendent Gill, of the Western Union. After Chairman Graham had read the general ordinance, Mr. Patton, one of the committee, said: "We passed an ordinance that all wires should be placed underground by Jan. 1, 1884. It was inoperative. The wires are not underground yet. You'll never get the old companies to put a foot of wire underground by passing this bill. We should confer with the officers of the different companies, and devise a practical ordinance."

Mr. Freeman said that was just what had been done: "We went over this ordinance with Mr. Bentley and other telegraph and telephone officials."

Mr. Bentley said he had not accepted the bill.

"The object is to make the bill right in every particular," continued Mr. Freeman. "The companies are all represented here. We are all here. In a multitude of counselors there is wisdom."

Mr. Clay said that he was enthusiastic for underground wires six years ago, but that a great deal of his enthusiasm had vanished, as he considered that many of the underground companies were nothing but swindles. It was finally agreed to postpone action until Thursday, and the matter was referred to a sub-committee of five members to report at that time.

It is the general opinion of those who are good judges that another year will pass and still see the wires overhead.

Mr. Stephen Holbrooke, the manager for the Schuyler Electric Light Company here, reports the sale of two plants of that system during the past week.

The Novelty Electric Company report business improving.

Partrick & Carter report business improving, especially the sale of their make of annunciators.

PHILADELPHIA, May 31.

Mr. Geo. T. Manson, the well-known and popular purchasing agent of the New England Telephone Company since its organization, resigned his position June 1st to go with the Okonite Company, of New York. Mr. Manson has been known in the telephone field for more than six years, and leaves it with an excellent record. His hosts of friends may be sure he will be heard from in his new field of labor, if energy and pluck are any elements of success.

At the meeting of the Old Timers' Telegraphers' Association in New York last November it was resolved to take the remains of James F. Leonard, said to be the first "sound" reader of the Morse telegraph, back to his old Kentucky home, and to erect a handsome monument. He died at Columbus, Miss., in 1862, twenty-seven years old. His remains were laid beneath a handsome monument at Frankfort last Friday. On one side of the monument are the words: "'Called' home by the grand 'Chief Operator' to work the Eternal Circuit Above."

Telephonic News

⁂ At a meeting held May 25, the Indianapolis Council passed the ordinance of the Citizens Telephone Company, owning the Wallace patents.

⁂ It is reported that there will be two reports from the Congressional Telephone Committee, one will be signed by all the Democratic members, and the other by the Republicans.

⁂ There is said to be a little unpleasantness existing between the directors of the Pan-Electric Company in St. Louis, all on account of certain shares of stock used in the election of the board.

⁂ The Central District and Printing Telegraph Company, which controls the Bell Telephone patents in western Pennsylvania, is making some important changes in its lines of wire. At present it is replacing some 200 miles of wire throughout Pittsburgh with a hard copper No. 14 wire that costs $25 a mile. The iron wire that is being removed costs $9 a mile.

⁂ The Graphophone Company, owning the patents of Mr. Bell's newest invention in telephones, has its legal habitat at Alexandria, Va., having been chartered in that city under the name of the Volta Graphophone Company, by Judge Kieth, of the circuit court, several weeks ago The corporators are A. G. and C. A. Bell and Sumner Taintor.

⁂ It is not to be forgotten that Mr. Zenas Wilber's affidavit is confirmed by the fact that he presents to all the papers a diagram of the Patent Office, with figures and references showing "where I was bribed." This is a pictorial confirmation of the damning charge. When you can produce a diagram of anything it usually settles any question of veracity. In Italy is that famous church through whose window "the devil threw a stone" in the ninth century. When scoffers stand at that holy altar and turn up to the sacred window an incredulous eye the monk in charge calmly unlocks a small sacristy and hands out a stone about as large as a man's head, with the remark: "This is the stone." That always decides it, for if the devil did not hurl it through the window how could that be the very same stone?

⁂ The following information for stockholders has been sent out from Salt Lake City, Neb., by Secretary Smith, of the Rocky Mountain Bell Telephone Company, under date of May 17:

Statement for Three Months Ending December 31, 1885.

Gross earnings	$23,101 73
Expenses	16,714 11
Net earnings for the quarter	$6,387 62
Add surplus, Sept. 30 h, 1885	19 573 98
Total surplus earnings, expended in construction to December 31st, 1885.	$25,961 60
Cost of construction during the quarter	$1,521 17

Statement for Three Months Ending March 31, 1886.

Gross earnings	$23,185 65
Expenses	15,360 90
Net earnings for the quarter	$7,824 75
Dividend @ 1 per cent. paid January 15th, 1886	3,910 00
Surplus for the quarter	$3,914 75
Cost of construction during the quarter	$525 00

The following toll lines have been built since the last statement:

Butte City to Silver Bow, Montana	6 miles.
Drummond to Phillipsburg, Montana	35 "
Salt Lake City to Bingham, Utah	30 "
Salt Lake City to Sandy, Utah	13 "

The New Invention of the Messrs. Bell.

Prof. Alexander Graham Bell and his cousin, Dr. Chichester Bell, of Washington, have recently made a very remarkable discovery, which they think is quite as important as the transmission of the tones of the human voice through the telephone. They have discovered that a falling jet of water or a flame of gas burning in a room reproduces every word spoken and every sound uttered within a given distance. When two people join in conversation in a room in the evening, the gas which burns above their heads repeats every word they say, and sounds uttered in the vicinity of flowing water produced vibrations.

In the few years of its active existence the telephone has become so much a matter of course that very few remember the fascination it had for them when they first talked through it or heard the faint, distant voice which some one said sounded "just like your conscience." The same feeling of stepping beyond the border of recognized natural phenomena attaches quite as much to this new invention.

The elements concerned are a stream of water, sunlight and a glass plate. What it does, according to the published descriptions, is to record conversation by photographing the waves of sound, and from this photograph to reproduce corresponding waves—that is, the conversation that has been printed on the glass plate. The phonograph, to be sure, attempted this, but it depended on mechanical means that were not prompt and delicate enough to secure a satisfactory success.

It is well enough understood that whatever can repeat the waves of air produced by any loud sound will repeat the sound itself. It is the principle of the telephone. But in the telephone the original impulses are repeated instantly and die away forever. In this new apparatus, assuming that it really does all that it described, the waves are not reproduced in that form, but their effect on a jet of water, long known to be sensitive to such impulses, is caught by instantaneous photography and permanently recorded on a glass plate in the form of minute irregularities of surface. By suitable apparatus these elevations and depressions, which correspond to pulsations of air, are retranslated into air waves, and the voice is heard again. The water, or liquid of whatever kind it may be, is colored with bichromate of potash. If it were perfectly clear it would not answer, because the light used in photographing would pass through without resistance, and no record would be made on the tablet. The water is colored for photographing, and the jet is made to fall obliquely on a glass plate. The water spreads itself out on the glass plate and runs off. It is the water so spread out that is to be photographed as it passes. Words spoken cause the jet of water to vibrate, the vibrations in the jet cause corresponding vibrations in the film of water as it breaks and spreads on the glass plate and runs off. A ray of light is passed through that film and through the glass plate to a sensitive tablet behind. The vibrations in the liquid film are reflected in the variations of intensity of the impression made on the photographic tablet. Speaking continues, the jet keeps running, the film keeps passing over the plate, the recording tablet keeps moving as the film keeps moving, and the light, passing through this film to the tablet, makes a record of the speech far more accurate than any verbatim report.

The wonders worked by photography within the last few years will prepare anyone familiar with them to look hopefully for the success of this attempt.

Prof. Bell considers this discovery quite as important as that of the telephone, and his cousin, Chichester Bell, has gone to Europe for the purpose of bringing it before scientific men in England and on the Continent. Patents have already been obtained in all the principal countries of both continents.

⁂ It is no use talking about taking down the telephone poles till the anarchists have left the country. The lamp-posts are not high enough, besides they will only support one at a time.—*Baltimore Herald.*

Prof. Henry and the Magnetic Telegraph.

(*Continued from page 3.*)

house into a great inductive plate by soldering to it a copper wire, and leading that through an electro-magnetic coil to the ground, and with that he held converse with the distant lightning so far away that its voice could not be heard. If the gods of mythology, who hurl their thunderbolts, have a system in their signals, this apparatus would enable us to read their thoughts. Within a few months a device has been put into operation by which telegraphic communication is kept up between the running cars on railroads and the stations, so that the positions of all the trains may at any time be known, and protection against collisions assured. To do this, the metallic roof of the car is used as an inductive plate, just as was the house roof fifty years ago; and a wire passes from it through a signaling coil to the ground by way of the metal wheels and track. Near the roof outside, an electric wire is stretched on poles, through which electric flashes, like lightning, are sent, and they set up by induction in the roof electric currents similar to those passing over the wire, which are read as signals by the observer; and, conversely, signals are sent from to the wire by induction coils in the car. The experimental demonstration in Princeton has not been lost, though buried so long, and to-day it throws another safeguard around our lives.

The first electro-magnetic engine for generating power was made by Henry, at Albany, in 1831. His clear mind was not deluded into the belief that such an apparatus could supersede the steam engine as an economical motor, and he warned the world against that delusion. Zinc, as fuel in a battery, is more costly than coal in a furnace. Still, he saw, and said that, in exceptional cases it might be useful; a result now coming to pass, dependent, however, upon the discovery of magneto electricity, by which galvanic batteries are dispensed with, and electricity, made in quantities from some great and economical source of power, is distributed to Henry's machines wherever they may be.

In many volumes, some of which have perished by fire, and some remain, were laid out lines and plans of investigation by Professor Henry, needing only leisure and means for their development, covering fields where investigators have since reaped rich harvests of fame, but from which he was debarred by the pressure of his other occupations here. In those records are contained the evidence that the great intellect which did so much with so little, was capable of grasping the whole circle of physical science, and of enriching and adorning any department of it to which his efforts might be directed.

But he was destined for another career. A benevolent Englishman, inspired by the noble ambition to aid in elevating mankind, had bequeathed to the United States a great sum of money to be used for "the increase and diffusion of knowledge among men" It was a splendid gift, and a sacred trust. Who was to be found equal to the task of effecting this grand purpose? The civilized world was interested in that question. Mankind was the beneficiary of the trust; and all men were entitled to be considered in its administration. By the common consent of the wisest and best of Europe and America, Professor Henry, of Princeton College, was selected, and solicited to assume that onerous duty. What tribute was that to the achievements, the attainments and the character of the man! He must be famous, that his selection might at once command the assent of the world; he must be learned, that he may be able to carry out the purposes of the donor; and he must be virtuous, that he should not degrade the high office to any base or selfish uses. And thus he was called.

When brought to the parting of the roads, choice was extremely difficult. On the one hand a life devoted to the most delightful of all pursuits—the searching out the laws of nature, which are the thoughts of God; a reputation already great and daily growing; and a happy home, surrounded by congenial and loving friends, and undisturbed by cares for the present or the future. On the other hand, an abandonment of the field of scientific research, where the harvest was abundant and the laborers few; and a surrender to others of the prizes he saw glittering before him in the race he was running; and furthermore, a grapple with the problems of organization and finance, and with the discordant elements which the scheme of the Smithsonian Institution would necessarily evoke. He foresaw that he might find himself, after some years had passed, like a giant shorn of his strength; on the one side outrun in the race where he had ever been in the lead; and on the other so hampered and crippled as to be unable to accomplish the great objects for which alone he was about to abandon his first love. That high sense of duty which governed him in every act of his life decided the question, notwithstanding his firm conviction that in accepting the trust he left the happiest days of his life in the past.

Perhaps he might have decided otherwise if Princeton College had been then as it is now. Perhaps he then might have felt that, with such ample resources at his command as are now to be found here, his services to humanity might be greater as a soldier in the ranks than as a commander in the field. But at that time no one had arisen among the friends of this institution who, like the Medici of the fifteenth century, was able at the same time to gather the wealth of the world by the arts of honorable commerce, and to appreciate that the gathered wealth of the world owes its existence and preservation to science, to art and to literature; and that therefore it is due to education that it should be encouraged by noble gifts, such as have enlarged the capacity of the college of New Jersey, and reflected honor upon the names of those whose generous hearts, guided by wisdom, have led them to broaden these ancient foundations, and to arm with improved facilities the workers who are here devoting their lives to the advancement of knowledge. All honor to such men. Had such assistance come earlier, the career of the great scientist might have been different, but it was not to be, and thenceforth another life opened before him and another man was unfolded to the world.

Perhaps the highest praise that can be bestowed upon any man is to say of him that he is just equal to all the duties ever imposed upon him, and never above them; that his reserves are not called into action until the emergency requires them. Such men are the great benefactors of mankind Such a man was the secretary of the Smithsonian Institution. The principles he laid down for the administration of the noble gift of Smithson required time for their development, and promised no present brilliant results. The foundations were to be laid deep in the earth, where the laborer and his work were scarcely to be seen by the passer-by. No popular applause would greet the achievement for years to come, while popular clamor was ever ready to cry out against the waste of time and money that produced no instant fruits. The man of clear purpose and resolute will stood guard over the work, and with just force enough, and no more, drove off the assailants till the foundations were all secure, the superstructure begun, and it was strong enough to stand alone.

With the skill that would have adorned a professional diplomatist, he temporized and compromised when he could no longer contend with success; with the dash that would have illustrated a general, he attacked when the moment was propitious and the adversary off his guard. With the earnestness of sincere conviction, and the directness of demonstration with which his scientific training had armed him, he convinced, one by one, those who opposed his views, until at last the regents of the institution and Congress surrendered their judgments to his, and the field was won.

A great library was the dream of Mr. Choate the most scholarly and persuasive of advocates; and, as a regent, he possessed and wielded a formidable power. It was hard to persuade him that a library does not "increase knowledge among men," and that it is very likely to "diffuse" ignorance. To discover and accumulate new truths, and to diffuse them over the whole earth, was the secretary's conception of the donor's intention; to pile up in Washington a miscellaneous collection in print of old truths and old errors was the idea of the scholars, and they were so strong that a temporary compromise was necessary. The vigorous growth of the true conception at last overshadowed the false one, and the library no longer saps the life of the Institution. Professor Henry always thought that over every library portal should be written some such warning as—"Cave Canem"—beware of the lies.

It was not till 1852 that the serious attacks upon the Smithsonian came to an end. On the 24th of June, of that year, a United States Agricultural Convention met in the theater of the Smithsonian building The plan to plunder the institution seems to have been carefully considered and matured; and the officers of the Smithsonian were elected members of the convention. Stephen A. Douglas was at that time at the height of his power. He had risen from the ranks by the arts of the politician and was the most influential man in the Democratic party of that day. Although not yet forty years old, he had just succeeded in defeating General Cass in a contest for the presidential nomination at Baltimore; and although he failed by a few votes to secure it, he had thrown it to Franklin Pierce, of New Hampshire, and thus kept it open for himself in 1856, as the Western candidate of the party.

He was styled the "Little Giant"—not in derision, but in admiration; as expressing the combination of a small stature and great intellect. Representing in the convention what was then an almost entirely agricultural constituency, he thought that votes were to be got and his influence strengthened, if he could bring home to them the spoils of the Smithsonian; and accordingly a resolution was introduced petitioning Congress to appropriate a portion of the Smithsonian

money for an agricultural bureau; and Judge Douglas undertook the congenial task of accomplishing the raid. The recollections of that battle are among the valued treasures of memory, associated in my mind with Joseph Henry. In such an assemblage, and with such a cause, Douglas was an adversary to be feared by any man. That he was an accomplished politician was proved by his great success; and he was there to fix another step in the ladder by which he had climbed so high. His speech was adroit, as only he could make it. Its argument was founded upon the proposition that civilized man depends upon agriculture, without which barbarism would sweep over the land; and his conclusion was that the farmer was entitled to whatever assistance could be got out of the money of Smithson, whose benevolence could best be applied in encouraging those who were at the very foundations of civilization. It would be great injustice to Judge Douglas to assume that he supposed the diffusion of papers of turnip seed among farmers was that sort of "increase and diffusion of knowledge among men" designed by Mr. Smithson; but no doubt it would be an increase and diffusion of the knowledge that he was the friend of the farmer, and that was of more importance to him. The secretary, surrounded by a few earnest friends, and prepared for the assault, sat in the back seat of the theater, quite unnoticed, kindling with righteous indignation at this nefarious plot to confiscate the funds of which he was the chosen guardian, and to destroy the institution devised by his intellect, reared by his unceasing efforts, and guarded so far by his sleepless vigilance.

When the popular applause following the "Little Giant's" popular speech had subsided, the secretary arose. In measured and dignified words he presented himself as the guardian of that fund, bound, so far as in him lay, to defend it from spoliation. He first developed the moral aspects of the question, and appealed, over the head of the advocate, to the honesty of the constituents he represented, expressing the most generous confidence that the farmers of this country would never consciously be parties in an attempt to seize that which belonged to mankind in general, or seek by a forcible partition to destroy the unity and efficiency of the fund.

The legal aspect of the question he next discussed like an equity lawyer, and denounced in scornful sentences that attempted breach of trust which was implied in the resolution.

And then, out of that fulness of his knowledge, with abundance of illustration and example, he demonstrated that the discovery of new truths, and their application to the arts, had elevated the farmers from the mere drudges they were in the seventeenth century to their present high state of intelligence and comfort.

The effect was overwhelming, and the "Little Giant" must have felt that there was another "giant" there, to whose title no diminutive prefix could be properly applied

The meeting adjourned till the next day, and these significant words were written in the secretary's diary, under date of June 25: "Judge Douglas, toward the close, made an apology for the warmth of his expressions. I did the same. Judge Rusk followed—so the whole was amicably settled."

Since that day no further assaults have been made on the Smithsonian Institution; and it stands a proud monument to the genius, the learning, the labor and the character of the great secretary who was content to sink his personality in the impersonal institution—to be overshadowed by the creature of his own creation, in order that true knowledge might the better be increased and diffused among men.

The conscientious obligation he felt pressing upon him to lose no opportunity for diffusing knowledge and correcting error, imposed a vast amount of unrecognized and unrequited labor. The intellectually halt, and lame, and blind, continually resorted to him for help, either in person or by letter; and they never were sent away empty. Like the home of the lonely country parson in the Deserted Village,

> "His house was known to all the vagrant train;
> He chid their wanderings, but reliev'd their pain."

They who have witnessed some of those deeds of charity, will never forget the gentle patience with which he listened to the beggars for knowledge, and the simple way in which he conveyed to their imperfect intelligences the truths they were seeking. Their self-conceit was often offensive; but he knew it was the product of ignorance, and his effort was to cure the disorder. He was no more repelled by the disagreeable symptoms than the physician is who must treat a loathsome disease. One one occasion, in my presence, one of these cripples refused to accept the instructions of the great physicist, on a very simple question of dynamics, applicable to a project he had in hand but instead of dismissing him, the master quietly took down "Hutton" from the book-case, and patiently read that author's confirmation of the law he had been teaching. What an exhibition of true humility! Perhaps, thought he, "I can give a new direction to this man's mind, who may yet do something useful; and what matters it that he scorns me."

No one can form an adequate estimate of the vastness of his mind, of the extent and accuracy of his learning, and of his power to discern the correlations of knowledge, who has not carefully read the instructions mapped out by him for the guidance of investigators working under the auspices of the Smithsonian Institution. They constitute a set of charts, which, for years to come, will guide the explorer safely and surely in future voyages for the discovery of new truths; and are a monument, attesting the fidelity with which the great trust was executed, and vindicating the sagacity of those eminent men, who, in 1846, saw, what his innate modesty forbade him to see, that Joseph Henry was, of all living men, the most fit to administer a fund whose object was "the increase and diffusion of knowledge among men."

Passing by thus hastily the great achievements illustrating the long and happy life of Henry, let us examine with more particularity his connection with the electro-magnetic telegraph; whose creation has so largely modified the course of modern civilization, and endowed the dull earth with nerves, like those of the living frame, whereby the whole body of mankind instantly feel the joys or sorrows of any of its members.

How to communicate intelligence instantly, over distances so great that the voice cannot be heard, had been well known to organized societies from remote antiquity. Visible signals made by moving vanes by day, and lighted torches by night, were known to Greeks and Romans alike; and more recently the alphabet was associated with these movements, so that alphabetical messages were freely communicated.

Even barbarous nations and tribes possessed this art in a high degree of perfection; and the arrival and progress of Cortes in Mexico were communicated by telegraphic signals, corresponding with the sign language of the Aztecs, to the capital of the doomed Montezuma.

When atmospheric electricity came to be artificially generated, it occurred at once to ingenious men that it might be used for telegraphy; and, in 1774, the first electric telegraph ever constructed was established at Geneva by Lesage He used twenty-four wires, each connected with an electroscope, whose function it is to move when the wire is charged with electricity, and by means of which any of the letters of the alphabet could be transmitted, by simply discharging a prime conductor of an electrical machine into the wire corresponding to that letter. This complicated apparatus was subsequently improved by using only one wire, and causing lettered wheels to revolve synchronously at the two stations, so that the same letter would appear at the same time to both operators. By this apparatus, whose principle of synchronous revolution is the same as that used in the printing telegraph, the sender would simply close the circuit on his electrical machine when his revolving wheel presented the desired letter, and the pith-ball electroscope, moving at the receiving end at the same instant, would indicate to the receiver that the letter then presenting itself to him on his wheel was the one intended.

A number of other inventors used static electricity for the same purpose during the latter years of the last century, and the earlier ones of this. In England, Ronalds had a line of eight miles on which the wire was suspended from poles, and insulated by silken strings; and in 1796, Salva, in Spain, worked a line by static electricity twenty-six miles long.

In the year 1800 Volta produced the voltaic pile, and gave to the world that new manifestation of electricity called galvanism. In that form this subtle agent is far more manageable than in the form of static electricity; and by the use of galvanic batteries a current of low tension, but of enormously greater power, can be maintained with little difficulty; whereas static electricity is like lightning, and readily leaps and escapes on the surfaces on which it is confined. The galvanic current also readily decomposes acidulated water and many other substances, and this capacity was soon applied to the purposes of telegraphy. Soemering, in 1807, invented a telegraph on this plan, and continued it for several years in Munich, publishing accounts of it in scientific journals, and exhibiting it to learned societies. Others followed his lead, until finally it came into commercial use in England in 1846 as a rival to the electro-magnetic telegraph of later invention, but requiring its aid as an alarm.

In 1820 Oersted discovered the capital fact that a galvanic current, passing through a wire placed horizontally above and parallel to an ordinary compass needle, will cause that needle to sway on its axis to the east or west according to the direction of the current through the wire. At once Ampere suggested the application of the new discovery to the old telegraph, whereby galvanism might be substituted for static electricity, and the deflection of a magnetic needle for the divergence of the pith balls of the electroscope. Baron Schilling, a Russian nobleman, inspired by the love of science, accordingly took up this suggestion, and constructed a galvanometer or needle telegraph, which in a practical and operative form was exhibited to the Emperor Alexander in 1824, and came to be well known to scientific persons at that time.

In 1833 Gauss and Weber set up a single circuit galvanometer telegraph on this plan at Gottengen, leading the wire over the house tops on insulators, as we do now, and by the deflections of the needle to the right and left made up the alphabet, as it had been done before when using other means for moving the vanes.

Their apparatus, however, is perfectly silent. The needle is suspended by a thread when the noiseless current sways it to and fro with but feeble force, and it is incapable of calling the attention of the operator to receive its message. These were serious difficulties, to be overcome by other principles and other inventions, which would supersede this one.

Following Oersted, Arago, in France, in 1820, made the next capital discovery. It was but a little thing he saw—simply that a sewing needle, surrounded by a coil of wire, through which a voltaic current passed, had become magnetic, but that little thing has grown to be mighty. This observation was the complete discovery of electro-magnetism, which had been dimly seen in Oersted's galvanometer, and was the germ of the electro-magnet. For four years this beautiful discovery was experimented with by all the scientists in Europe before another step was taken; and then William Sturgeon, of England, produced the electro-magnet. It consisted of a large soft iron wire, bent into a horse-shoe form, coated with varnish, and wrapped with a spiral coil of naked copper wire from end to end, through which the voltaic current might be passed. This bent wire became a magnet while the current flowed, but lost its magnetism when the current ceased.

Here then was born into the world an apparatus capable of exerting a stronger power at the will of the operator, by merely opening and closing the voltaic circuit; and it was then thought that the difficulties in the way of the telegraph were conquered. The experiment was soon tried with Sturgeon's magnet by Barlow, an eminent scientist; and in January, 1825, he published his results in the *Edinburgh Philosophical Journal*, in these words:

"The details of this contrivance" (a telegraph) "are so obvious, and the principle on which it is founded so well understood, that there was only one question which could render the result doubtful; and this was, is there any diminution of effect by lengthening the conducting wire?" If not, he proceeds to say: "Then no question could be entertained of the practicability and utility of the suggestion above adverted to. I was, therefore, induced to make the trial; but I found such a sensible diminution with only two hundred feet of wire, as at once to convince me of the impracticability of the scheme"

Barlow's experiment was repeated by other scientists in that and following years with a like result; until it came to be accepted in the scientific world that the telegraph could not be worked with the newly-discovered electro-magnetism. So strongly was this fixed in the opinion of the day, that as late as 1837—thirteen years after the invention of the electro-magnet by Sturgeon—so eminent a scientist and discoverer as Wheatstone, pronounced the electro magnetic telegraph impossible, on an occasion when the very question was submitted to him for decision by Cooke, at the suggestion of Faraday himself. This fact is so important, and so conclusive on the question now under examination, that I read Wheatstone's own account of it, submitted by himself to arbitrators who were to decide a controversy between himself and Cooke as to their respective merits as inventors of one form of the electro-magnetic telegraph. He says:

"I believe, but am not quite sure, that it was on the first of March, 1837, that Mr. Cooke introduced himself to me. He told me he had applied to Dr. Faraday and Dr. Roget, for some information relative to a subject on which he was engaged, and they had referred him to me as having the means of answering his inquiries * * Relying upon my former experience, I at once told Mr. Cooke that it would not, and could not, act as a telegraph, because sufficient attractive power could not be imparted to an electro-magnet interposed in a long circuit; and to convince him of the truth of this assertion I invited him to King's College to see the repetition of the experiments on which my conclusion was founded. He came, and after seeing a variety of voltaic magnets which, even with powerful batteries, exhibited but slight adhesive attraction, he expressed his disappointment."

Cooke confirms this statement by saying: "It was my inability to make the electro-magnet act at long distances which first led me to Mr. Wheatstone."

Let the difficulty of making the discovery which overcame this impossibility be judged by the fact, that for so many years, such men as these were unable to do it when it was needed; and let that fact answer the envious suggestion that Henry's achievement involved no great amount of analytic and inventive power.

When Barlow's demonstration was published in 1824, Henry had never seen an electro-magnet, nor tried an experiment in electricity. When, however, two years later he took up the subject, and began the first set of regular scientific investigations ever attempted in the United States he deduced from Ampere's law the principle that the voltaic currents, carried on wires around the iron core of the electro-magnet, should move in planes at right angles to the axis of that core—which they could not do even approximately if the core itself were insulated, as in Sturgeon's small magnet, having only one coil of naked wire wound spirally around it, necessarily leaving open spaces between the successive spirals and so leading the current like a cork-screw around the core. He also reasoned that, as the current must be led through a spiral circuit, which theoretically should be circular, the departure from its true course might be counteracted by winding the wire on a second spiral outside of the first, but with its spiral angle opposed, so that the resultant of the current from the two spirals would be the same as if it revolved in planes at right angles to the axis of the core.

He brought his reasoning to the test of experiment. Instead of insulating the core, he wrapped a fine copper wire with silk, and wound it on the core; each spiral closely packed against its fellows, so as to correct the spiral error as much as possible in each layer; and then he wound the wire in a second spiral over the first, but with the pitch of the screw, so to speak, in the opposite direction. And carrying out the principle he multiplied the coils to an enormous extent in the same way. The result justified and established his theory; and his magnets at once showed a capacity hundreds of times greater than any then known to science.

But this was not all. Another step had to be taken before Barlow's demonstration could be overthrown, and the telegraph made possible. And this he took by discovering and establishing the fact, that a magnet with a long fine wire coil must be worked by a battery of "intensity," composed of a large number of shells in series, when a distant effect was required; and that the greatest dynamic effect, close at hand, is produced by a battery of a very few cells of large surface, combined with a coil or coils of short coarse wire around the magnet.

These discoveries and inventions solved the problem which had seemed to European scientists insoluble; and in one account of them which was published in *Silliman's Journal* for January, 1831, he says: "The fact that the magnetic action of a current from a trough is at least not sensibly diminished by passing through a long wire, is directly applicable to Mr. Barlow's project of forming an electro-magnetic telegraph." This reference was to Barlow's paper of 1824, in which he had demonstrated the impracticability of the telegraph.

Had these things been done in the Royal Institution, and read before the Royal Society, Wheatstone would not have been found, in 1837, denying the possibility of an electro-magnetic telegraph; and Faraday would not have been able to answer Cooke's question, without sending him to Wheatstone for the information. In those days, however, the United States were held in no higher estimation in Europe, than Nazareth was in former days in Jerusalem; and no one in England read an American book.

But not content with having reasoned out, and demonstrated, that distance was no longer the sole impediment in the way of the magnetic telegraph, Henry, in 1831, established the first electro-magnetic telegraph that ever existed. In the Albany academy he strung a mile of line wire, and with an "intensity battery" at one end, and his spool of long fine wire at the other, he operated the armature of the first sounding telegraph of any kind. When the armature was attracted by the magnet, it struck a small bell or sounder, which spoke its signals; and that apparatus there was maintained to illustrate the telegraph to the students.

When applied to practical use, some code of signals must be arranged for translating the successive taps of the armature; but that was well known in the telegraphic art for ages, needing only good judgment in arranging it, so that the letters which occur most frequently shall be represented by the smaller number of motions; just as Gauss and Weber arranged their needle-telegraph code in 1833, when the movements of their needle to and fro, in a number of simple combinations, indicated the alphabet.

These "spools" of Henry have been the means by which most of the great discoveries in electro-magnetism have since been made. Faraday and Henry used them in their famous researches already referred to, in which they discovered magneto-electricity. Sturgeon, in writing of them, says: "Professor Henry has been enabled to produce a magnetic force which totally eclipses every other in the whole annals of magnetism, and

no parallel is to be found since the miraculous suspension of the celebrated oriental impostor in his iron coffin." Without them we could not have the telegraph, or the still more marvelous telephone. They are to-day essentials of modern living, and are as familiar to us as spools of cotton. Judging by their results, they constitute the most important discovery which has ever been made in electricity since Volta created the battery.

Henry also put in operation at Princeton in 1835 the very simple and obvious plan of using the "intensity spool and battery," working through long distances, to open and close the circuit of 'quantity spool and battery," stationed where the work was to be done; thus making the powerful magnet, at short range, the servant of the weak one at long range. In this state he left the problem entirely solved, to those who could procure the money to practically apply his discoveries to the commercial uses of man.

That task was no easy one. In 1831 there were no railroads and no steamships. Over rough country roads the mails were carried in wagons or coaches and the postage on a single letter was a shilling for short distances and twice as much for longer. But little capital had accumulated in this country; and corporations—those powerful instruments for uniting the slender means of the many into a compact force for the development of great industrial enterprises—were hardly known. If the most perfect telegraph apparatus of to-day had been then presented to the public, no company could have been formed to exploit it. The time had not yet come; nor could it come until railroads were built, and the exchange of material things had been rendered easy.

In Europe, where money and railroads were more abundant, the telegraph was first put into practical use. Wheatstone and Cooke, in England, in 1838, having first, however, seen and talked with Henry on the subject in 1837, after they had first decided the thing to be impossible, established a practical commercial telegraph line between Paddington and West Dayton, a distance of thirteen miles; and a shorter line was in Munich. In this country private capital could not be raised for the purpose at all, not because there was any doubt that the thing could work, but because no one supposed it would repay the investment, as it certainly would not have done in those early days. At last Congress was induced to do what private enterprise refused, and in 1841, six years after the English lines had been in practical operation, and seven years after the Bavarian, money was appropriated for the line between Baltimore and Washington. This was accomplished, after great exertions, by persons hoping for the reward which a patent for some of the contrivances connected with that particular plan promised.

Neither in England, where Wheatstone had a patent founded on Henry's inventions, nor here, where Morse had a similar one, could the telegraph have been introduced for years after it really was, but for the beneficient operation of the patent laws. But few men are to be found who will incur the risks, and expend the money, incident to the introduction of a new and untried industry, without the hope of that pecuniary return, which in such cases can only be secured by the exclusive use for a "limited time" of the new thing, during which it is hoped the original losses may be repaid and a profit earned.

Let us now consider what would have been the position of Henry in the world, if at any time before his inventions had been so long in public use that he had lost his rights, he had taken a patent for.

First, his magnetic spools, pure and simple;

Secondly, the combination of a magnetic spool of long fine wire, with an "intensity battery," for the purpose of producing a practical magnetic effect at great distances;

Thirdly, the combination with such an apparatus of a quantity battery, operating upon a spool-magnet of coarse and short wire, at a distance from the intensity battery; whereby the great lifting power of the quantity magnet might be controlled by the intensity combination;

And finally, the combination of the intensity battery and spool, with a vibrating armature, so arranged as to strike a sounder when the circuit is closed or opened at the sending end, for the purpose of transmitting intelligible messages telegraphically.

All these he might have patented in the United States at any time during several years after his discoveries and inventions were made; and he could have held them against the world. That he was the first man to do all these things is not in doubt anywhere. If he had taken such a patent as late as 1837, he would have controlled the telegraph in this country, certainly until 1851; and unless he had then been adequately rewarded for his great inventions, his term would have been extended till 1858. Imagine the good he would have done to science had the wealth which this would have produced been poured into his purse! But listen to his noble words: "At the time of making my original experiments in electro-magnetism in Albany, I was urged by a friend to take out a patent, both for its application to machinery and to the telegraph; but this I declined, on the ground that I did not then consider it compatible with the dignity of science to confine the benefits which might be derived from it to the exclusive use of any individual."

Pure science was his beloved, and he could not make merchandise of her.

When that sentence was written, other eminent scientists had thought differently of this question, and had patented their discoveries; and, lest he might seem to cast a reproach upon them, and to say, "I am holier than thou," his humble spirit added these words: "In this, perhaps, I was too fastidious."

It must have occurred to him at times, when he needed money for his experiments, and when he saw the fruits of his labor enriching the world, that he might have taken some share of the wealth; but he would not taint with selfishness his generous gift. How valuable in money it was he know full well. Even for that fragment of it, then for six years by him given to the public, which was carried to Morse in 1837 to enable him to construct his special plan of a recording telegraph in that year, now practically obsolete, Dr. Gale, who carried it, received a share in the patent which was founded upon it, and without which it could not have existed. For that share fifteen thousand dollars in cash were subsequently paid to him. And its use for the telegraph was but a small part of its infinite variety of applications to the arts, and the purposes of man.

Come with me now into a telegraph office, and let us see what we find there. If the line be a short one—say thirty or forty miles—you will see but one of Henry's spools, fixed to a table, having a piece of iron called an "armature," capable of vibrating in front of its poles, and so arranged that when the "spool-magnet" attracts it, it will vibrate and strike a sounding-bar of sonorous metal, which gives out distinctly the sound of the tap. The "spool" is wound spirally in layers with several hundred feet of fine copper wire, covered with silk, in the manner specified by Henry in *Silliman's Journal*. At the other end of the line is a battery, composed of a number of cells in series, called by Henry for distinction an "intensity battery;" and the wire circuit is supplied with a simple device, so that it may be opened or closed by the operator's finger. When he closes it a current of electricity flows from the "intensity battery" along the wire, and around the coil of the "intensity magnet," and the armature strikes the sounder and gives the signal. The listener hears it; and as the order of the taps progresses in accordance with a pre-arranged artificial code, to express the letters of the alphabet by combinations of successive taps—just as the old visible signals were arranged by combinations of the successive movements of the vanes, or afterwards of the needle of the Gauss and Weber telegraph—he hears letter after letter tapped out, and the message is understood.

Now, that apparatus has nothing about it more than was in Henry's Albany telegraph of 1831; nor could it operate if it omitted any one of the inventions, either singly or together, which were then for the first time combined. It depends entirely upon the discoveries made by Henry before 1831; and it could not have existed in the world earlier than those discoveries, by the use of any means then known to man; nor since by any other means than those discovered by Henry.

Henry used a bell as sounder; they now use a metal bar and a sounding box. Henry reversed the battery current, whereby no spring is needed to withdraw the armature for the purpose of vibrating it; and that is the common practice in English and German telegraphs. Here they generally merely interrupt the circuit, and the armature is withdrawn from the magnet by a spring, although Henry's device is also used here largely, and is essential to the quadruplex instruments.

If, however, the telegraph line is a long one—it may be a thousand miles or more—then you will see two sets of Henry's spools, and two batteries. One is the "intensity battery and spool" first described; and the coil of fine wire may be, and often is, several thousand feet long—while the battery is composed of more than a hundred cells. The distance being so great they do not attempt to send force enough through the intensity circuit to operate a sounder, but only to open and close the local circuit of Henry's quantity battery and spool. That circuit consists of a battery of but one or two cells of a large surface, and a spool with about a hundred feet of coarse wire wound around its core. The intensity combination opens and closes this quantity circuit, whose armature strikes the sounder, just as the intensity armature itself does on shorter lines. This obvious plan Henry described and exhibited in Princeton to his classes, long before any magnetic telegraph was ever commercially constructed, or the convenience of such an arrangement had resulted from the great length to which the lines are stretched.

Upon that apparatus there are but four names to be written. Oersted, who discovered the effect of the voltaic current upon the magnetic needle; Arago, who discovered that the voltaic current could generate magnetism; Sturgeon, who produced the first electro-magnet; and Henry, who discovered the conditions under which an electro-magnet might be operated at a distance—who invented the devices by which it could so operate—and who applied those devices to an operative telegraph, of the same form and substance as that now in use all over the world. Beyond their discoveries and inventions nothing is essential to the present telegraph, except that which was of common knowledge when those discoveries were completed, and that ordinary mechanical skill which is far below the level either of discovery or invention.

This is the record, and so it will stand for ever.

"The moving finger writes; and having writ,
Moves on: nor all your piety nor wit
Shall lure it back to cancel half a line,
Nor all your tears wash out one word of it."

Forty years had fled away since as teacher and pupil we first met, and they seemed like a dream that is past, when again we meet to part forever in this world. In the chamber where the angel of death hovered over him, just ready to call him away, he talked thankfully of the past and hopefully of that eternity on whose verge he stood. The vigor of youth and of manhood had been all spent in the service of humanity, and his strength was gone. The pallor of disease had dispelled the delicate hues of health, and time had traced its furrows on his brow. But the unclouded intellect still held its sway, enthroned in that magnificent head on which the snows of many winters had drifted; and the gentle loving spirit still, as of old, illumined his beautiful face, but with a clear, warmer light, reflecting the heaven upon he gazed. For himself he had but one regret—that he had not been spared to complete his last great labor, by which he hoped to confer still one more benefit upon humanity, by discovering some means affording greater security for mariners on the treacherous coast, when fogs draw down their impenetrable veils over the lights, and the syren's voice fails to pierce the fickle air.

The faithful servant—faithful unto death—only mourned that he could not have done more. With the humble spirit of the true Christian after having in the estimation of his fellow-men done so much, he, knowing better than others how much was yet to be done, exclaimed, "I am an unprofitable servant."

Such a life and such a death exalt and glorify humanity; illustrating and indelibly impressing upon our hearts the sublime truth, that man is made in the image of God.

"Along the smooth and slender wires, the sleepless
heralds run,
Fast as the clear and living rays go streaming from
the sun;
No peals or flashes, heard or seen, their wondrous
flight betray,
And yet their words are quickly felt, in cities far
away."

Telephone Work in May.

The statement of the output of telephones of the American Bell Telephone Company, for the month ended May 20, is the most favorable which the company has made for any month thus far this year, as will be seen by the following tables:

May—	1886.	1885.	Increase.
Gross output	4,555	3,707	848
Instruments returned	1,359	1,265	94
Net output	3,196	2,443	754
December 21 to March 20—			
Gross output	17,054	14,332	2,732
Instruments returned	8,046	11,021	2,975
Net output	9,008	3,301	5,707

Comparison with previous months—

	May.	April.	March.	Feb.	Jan.
Gross	4,555	3,677	2,819	3,223	2,780
Returned	1,359	2,499	1,232	1,408	1,548
Net	3,196	1,178	1,587	1,815	1,232

The Association of Railway Telegraph Superintendents.

SECRETARY'S OFFICE,
123 DEARBORN ST., CHICAGO, ILL.,
May 11, 1886.

Editors Electrical Review:

The fourth annual meeting of the Association of Railway Telegraph Superintendents will be held at the Hotel Ryan, St. Paul, Minn, at 10 A. M., June 16th, 1886.

All members are requested to be present, and a cordial invitation is given to superintendents, chief train dispatchers and chief operators to join the association and participate with us in this meeting, which will be one of interest and profit.

C. W. HAMMOND, President.
GEO. L. LANG, Vice-President.
P. W. DREW, Secretary.

European Telephone Statistics.

ITALY.

Towns.	No. of Subscribers.	Pop'lat'n	Population per Subscriber.	Subscription in Francs.
Rome	2,054	300,000	146	174
Milan	925	419,787	454	184
Genes	915	180,000	197	160
Naples	810	500,000	595	200
Turin	758	252,832	334	186
Florence	686	163,112	238	140
Palerme	440	234,000	532	200
Bologne	400	123,274	308	130
Livourne	346	97,096	281	160
Catane	213	100,000	469	200
Venise	200	132,000	660	200
Padoue	160	66,107	413	150
Mesine	138	125,000	906	200
Pise	105	50,341	479	120
Brescia	100	40,499	405	—
Sampierdarena	60	—	—	150
LUXEMBURG.				
Luxemburg	120	16,679	139	—
HOLLAND.				
Amsterdam	1,195	335,000	280	248
Rotterdam	623	157,500	253	252
La Haye	206	117,000	568	252
Arnhem	133	41,500	312	252
Utrecht	112	70,000	625	252
Dordrecht	87	27,500	316	252
Groningen	73	47,000	644	252
Haarlem	64	38,000	594	252
PORTUGAL.				
Lisbonne	497	223,000	449	—
Oporto	329	110,000	334	—
RUSSIA.				
St. Petersburg	1,100	850,000	773	575
Moscow	650	800,000	1,231	575
Varsovie	600	350,000	583	575
Helsingfors	575	46,000	80	200
Odessa	500	220,000	440	345
Riga	400	135,000	337	345
Abo	250	27,000	108	150
Lodz	200	180,000	900	345
Wasa	150	7,000	47	150
Wiborg	150	18,500	123	150
Uleaborg	140	10,000	71	150
Tammerfors	120	16,000	133	150
Bjorneborg	105	9,000	86	150
Kuopio	100	8,500	85	150
Tavastechus	90	8,500	94	150
Borga	60	4,000	67	150
Kotka	30	3,000	100	150
Jyvaskyla	20	2,500	125	150
Kristinestad	20	2,500	125	150
Lavisa	20	2,500	125	150
SWEDEN.				
Stockholm	3,825	173,433	45	173.50
Gothoborg	738	76,761	104	167
Malmo	355	33,528	94	173.50
Northkoping	199	27,300	132	140
Sundsvall	180	7,000	39	167
Helsingborg	90	10,261	114	173.50
Hernosand	89	4,900	61	111
Lund	76	12,900	170	173.50
Soderhamm	73	6,200	85	174
Landskrona	72	—	—	173.50
Jonkoping	55	13,877	252	173.50
Umea	50	2,600	52	111
Uddevalla	42	6,600	157	111
Trelleborg	31	—	—	173.50
Eslof	29	—	—	173.50
Nyland	9	—	—	111

.... A correspondent of the REVIEW, Mr. S. Newton, of Xenia, Ohio, states that the damage done by the recent terrific storm in his city will amount to less than $100,000. Less than one-tenth of the city was flooded, and less than a dozen dwellings were destroyed. Twenty-eight lives were lost by drowning (nine white and nineteen colored) and scarcely a single other person was injured except by fright and exposure.

.... Telegraphic circles are greatly interested just now in the suit of the Bankers and Merchants Telegraph Company against the Western Union for $2,000,000. Former General Manager F. W. Jones, of the Bankers and Merchants, was on the witness stand the greater part of last week, and although subjected to a most severe cross-examination was fully equal to the occasion, and found to be thoroughly well informed in all the points at issue.

.... At the last meeting of the Electrical Society, of Buffalo, President Kitton announced the receipt of several valuable scientific works, and some experimental apparatus, which had been donated by parties interested in the establishment of the society's library and laboratory. Both these departments, he observed, were growing apace, through the united efforts of their friends and themselves; and he was glad to notice the appreciation shown by the members, as evidenced from the number of applications for the loan of the various works on hand. He expressed the hope that the interest in the proceedings of the society would be maintained, and that the advent to their new and desirable quarters in the Sherman block would be the means of bringing fresh accessions to the list of members.

A New Job for the Tramp.

He came in in a hurry. "I've got it," he shouted, "and its a big thing." An old Greek philosopher once made the same remark, and nowwe have "Eureka"—well, most everything. "What is it?" asked one of the members of a crowd who were holding down empty boxes and casks in the village store. "The greatest invention of the age. I am a philanthropist; I have long been trying to find a suitable occupation for the chronic pedestrians of the country, and those who board at the State's expense. Now, they can't saw wood, or make shoes, or mould stoves, etc., for the voters won't let 'em. My plan will not take work from any man's hand. You all know about 'lectricity (he often discoursed on that theme). The movement to and fro of a soft iron plate before the pole of a magnet will cause an increase or diminution of the number of lines of force, and, if there be a coil of wire around the magnet, alternating currents will be induced in the wire. Just like a telephone. My plan is to make all tramps shout into such a machine, a portion of the current being employed to stimulate the aforesaid tramp to greater action, and the remainder to be distributed for the purpose of light, heat and power;" and the crowd gave knowing nods, and no longer wondered why they felt so tired after talking through a telephone. "I can do it, no mistake," he rattled on. "A celebrated professor has by measurement shown that from such instrument I mention 10 per cent. as much current is obtained as is needed to work a sounder. Now, a man can talk into an indefinite number of these machines, and I can easily get enough to run an arc light." He went out, taking five feet at a stride, while the small boy of the store commenced experimenting on the electrostatic capacity of the cat.—*One of the O. G.*

More On the Primary Battery.

Editors Electrical Review:

The communication of Mr. B. A. Terry in your issue of even date, recommending the sulphate of copper battery as a cheap, constant and reliable source for producing electric light might have been made interesting and instructive, had he given some definite figures upon which to base a comparison of his cell with those more recently devised and evidently referred to, or had he shown in what way the many difficulties surrounding the use of large elements could be overcome. No particular type or size of blue vitriol cell having been given, the reader is forced to calculate from the ordinary sulphate of copper cell having an E. M. F. of one volt and an internal resistance of two ohms, and the result of such calculation shows that it would require 112 such cells to give a current equal to one Volta Pavia cell, the E. M. F. of which is $2\frac{3}{10}$ volts, with a current of 28 amperes.

Mr. Terry is reminded that some weeks ago Mr. Howard, of the Chemical Electric Light and Power Company, extended an invitation to all inventors, proprietors or advocates of primary batteries to enter into a competitive test with the new Volta Pavia cell, to which no one has as yet responded.

W. C. GOLDNER.

BOSTON, May 22.

Electric Wires in New York.

One of the best-known men in theatrical and Wall street life is Theodore Moss, the treasurer of Wallack's Theater. He is also one of the three commissioners appointed to determine how and when and where telegraph and telephone companies shall lay their undergrouud wires, and, after being pushed and punched about the delay, said: "Between South Ferry and Forty-second street there are 314 streets intersected by wires, and there are from 310 wires on a single pole at Rector street and Broadway to one or two on the side streets. There are 7,500 telephones in the city. All these wires have to be put underground. The messengers' boxes are in a circuit, and they number 15,000. There are 10,000 miles of wire in New York. These comprise telegraph, telephone and electric light wires, and wires for fire and police alarms, for messenger service, electric time service and electric power service. There are as many telephone wires in New York as in all of Great Britain and Ireland combined. The percentage of wires already underground in this city is greater than in all Great Britain. To show one of the difficulties of the enterprise, there are 6,000 wires crossing Broad street between Wall street and Exchange place to be systematized in the subway. In New York there are 141,000 building lots. Of these less than 20,000 use electricity. The commission must look out for an immense increase in the use of electrical wires in the next ten and twenty years."

A Reply from Mr. Garratt.

Editors Electrical Review:

In reply to the letter from Messrs. Laing, Wharton & Down, of London, which appeared in the last issue of the REVIEW, I would say that the statements therein made are not sufficiently lucid to enable me to make an intelligent comparison of the cost of producing the incandescent light from primary batteries here in America, as compared with the cost in England.

If I am to understand that the above-named gentlemen can charge a primary battery, which will maintain twelve to fifteen eight candle-power lamps for 210 hours at a cost, for solution, of only one dollar and a quarter, and consume only twenty-five cents worth of zinc, I am sure that readers of the REVIEW will be pleased to read a detailed description of how it is done. If, on the contrary, they can produce eight candle-power of light for 210 hours at a cost of one dollar and a half, that is quite a different question. If Messrs. Laing, Wharton & Down will kindly publish in the REVIEW a more detailed estimate of the cost of incandescent light by their system (stating the cost to their customers) I will be pleased to reciprocate by stating the price of light by the Volta Pavia system of the Chemical Electrical Light and Power Company of this city. ALLAN V. GARRATT.

Boston, Mass., U. S. A., June 2.

To Members of the National Electric Light Association.

A meeting of the Executive Committee of this association will be held at the Hotel Dam, New York, June 29th. All persons who expect to prepare papers for the Detroit meeting, or who may have any facts of interest to the Association that they desire to present, are requested to notify the committee at this meeting; addressing as above.

A. J. DECAMP,
Chairman Executive Committee.

—— The New York office of the Mather Electric Company has recently secured a number of contracts for electric light installations and work is being pushed on a number of Starin's steamboats, and a thirty-five incandescent plant is being placed in Jacob New's silk factory, on West 55th street. The two boats being wired for the Mather system of incandescent lighting are the Sam Sloan and Mattewan, and each will have a quota of 75 lights. Mr. Starin will add to the popularity of his many elegant boats by adopting this light for all of them as he has in these two, which are among his finest.

—— Among the recent orders taken by the Star Iron Tower Company, of Ft. Wayne, Ind, are six towers for the Jacksonville (Ill.) Gas Company, and one tower for a new Panorama Company at Kansas City, Mo. Jacksonville has the Thomson-Houston lights and the Kansas City Panorama will use Ft. Wayne Jenney lights for their tower, and also to light their picture.

—— The Stout-Meadowcroft Company have removed their offices from No. 21 Ann street to more commodious ones at Nos. 82 and 84 Fulton street, where their factory is located. They propose to go into the manufacture of electrical apparatus for producing optical effects for theatrical purposes.

—— The Buffalo Council has ordered seven more arc lights to be placed on Benzinger street.

—— New Thomson-Houston arc lamps to the number of 75 have been placed in Poughkeepsie, N. Y.

—— The Haverford Electric Light Company, of Philadelphia, has been organized with a capital stock of $5,000.

—— Hornellsville, N Y., will be lighted by electricity. John M. Finch, is president of the company; A. S. B. Santee, secretary.

—— The Franklin Electric Light Company, of Cape May, N. J., after an investigation of the merits of various prominent systems, have decided to adopt that of the Schuyler Electric Light Company, and have ordered a 45-light plant through Mr. Stephen Holbrooke, of Philadelphia; also 100 horse-power steel boiler, etc., from the Ball Engine Company, of Erie, Pa. The plant will be in operation for the summer season.

——The fountains of the Indian and Colonial Exhibition, London, are illuminated underneath by nine large hand-feed arclamps, specially designed for this purpose. The carbon holders are mounted on insulating blocks, attached to saddles which slide on the brass tubes fixed to end-brackets, the whole being supported at about twenty degrees angle with the horizontal base plate. The feed is effected by a screw passing through the saddles between the tubular guides, one end of which has a right-hand thread, and the other a left-hand thread of double the pitch. This screw is carried through one end-bracket in a tapped bush, which is partly split and can be clamped on the screw by a nut running on an outside taper thread. When this is so clamped, the turning of the screw hand-wheel simply gives the necessary feeding motion, one carbon moving at twice the rate of the other; but if the tapped bush is unclamped and turned on the screw by a hand-wheel attached to it, the screw and carbon holders are bodily shifted longitudinally, thus giving a horizontal adjustment of the position of the arc. To give a universal adjustment of the position of the carbon points with regard to each other, one of the carbon holders consists of a bracket carrying a cylinder, fixed horizontally and at right angles to the screw. On this cylinder is a sleeve carrying the carbon holder proper, which can be moved horizontally, or turned on it in a vertical plane, thus giving a perfect adjustment of the points; this sleeve is moved and clamped in position by an insulated handle, which acts as a set-screw.

The Electric Light in California.

Certain parties have again commenced to growl about the electric light because it does not regulate the constitution of the air and the fogs that float around every night to darken the path of Third Warders of Los Angeles. It is proposed to pass an ordinance compelling the electric company to arrest all fogs and clouds found lurking about the city after 7 o'clock in the evening, and shut them up in the dog pound till sunrise. By this means light can be made more intensely brilliant than it now is on rainy nights. Then another ordinance should be introduced, compelling all moths and millers from flying at night, filling up the globe about the carbons and arresting half the light. Yesterday, says the Los Angeles *Herald*, about ten bushels of bugs of all sorts—ringed, streaked, plaid, speckled, gray, invisible brindle, black-and-tan, yellow, green-and-gold, red, white and blue, moonlight-on-the-lake, Solferno, Magenta, ash color, straw color and colors ad infinitum were taken from these globes. Their presence in the globes by three o'clock in the morning are a serious hindrance to the diffusion of light, and an ordinance should be passed and enforced to prevent these creatures from interfering with light, liberty and the pursuit of a door-knob after three o'clock in the morning. Meantime the fires glow, and the great machinery flies as fast as is safe without destroying the carbons. Prof. Warren, of the electric light company, states that he is running his machinery more rapidly than ever, and that the electric light is more intense than it was a year ago. The only remedy seems to be to pass these two ordinances and strictly enforce them. Fogs and bugs must go.

ELECTRIC LIGHT NEWS

—— The Worcester City Council has authorized the placing of 24 arc lamps for lighting the city.

—— The electric light system recently contracted for by San Bernardino will probably be extended to Colton, California. The Mill Creek water at a convenient flouring mill will probably be utilized as motive power.

—— In the city of Rochester, N. H., Messrs. Frenyear & Razee have put in a central station for incandescent and arc lighting, using their own system. Mr. Pfaunkuche is the electrician of the company. The city of Exeter, N. H., is also lighted by this system.

—— Eight car loads of the Dorsett conduit—comprising the first mile to be placed in Brooklyn, N. Y.—have arrived here from Chicago. This conduit is the first of the ten miles to be put down in the city of churches under the direction of the Electrical Subway Commission.

—— At the new circus in Paris the Johnson sisters are nightly astonishing the natives by their acquatic feats in a swimming bath which is lit up by electricity from below, so that, the theater being darkened, the water becomes a transparency in which the movements of the naiads can be minutely followed.

—— The Hecla Electric Light Company, of this city, have just installed a 25-light incandescent plant at Frank Malone & Co. North River, Whiting Works, 539 West Fourteenth street. They have also concluded contracts for arc plants with Geo. A. Mayo, Friendship, N. Y., and Joseph Doelger's Brewery, Fifty-fifth street, New York.

—— The electric motor was started on May 25 in Minneapolis, Minn., and through the day ran regular trips from Second to Sixth street, south. The working was regarded as very satisfactory, although it is intended to make it still better by correcting one or two slight defects that mar the their appearance in the track.

—— At the meeting of the Philadelphia Park Commission's Committee on Superintendence and Police, it was recommended that the proposition of the Thomson-Houston Electric Light Company to light the East Park be accepted. The agreement is to furnish ten lights at $1 each per night, amounting to about $1 200, from the middle of June to the middle of September, which is to be paid from the maintenance fund.

—— Chief Walker, of the Electrical Department, Philadelphia, has completed the arrangements for laying the underground cable in Broad street, between Columbia and Lehigh avenues, and the work has commenced In March the Council appropriated $2,500 for laying the conduits and wire, which will be placed along the east side of Broad street, in the center of the sidewalk, about ten inches from the surface of the pavement. The wire used will be that of the Standard Cable Underground Company, of Pittsburgh. When the trench is dug a half-inch layer of pitch will be laid in the bottom, and then wooden boxes, 2x3 inches in the interior in size, will be placed in position. Four cables, two of which are for electric lighting purposes, will be placed in position, with connection at each street corner for lamp poles, and then the lining of the boxes will be covered with roofing pitch. It is the intention at present to erect eight lights, one on each corner north from Columbia avenue on iron poles twenty-one feet above the level of the pavement. The remaining two cables which will be stretched through the conduit will be held in reserve for telegraph and telephone use at some future date Chief Walker expects to complete the work inside of ten days, and, when finished, will connect the cables with the wires of either the United States or Thomson-Electric Light Co., and thus obtain the power for lighting North Broad street. Connections can be made with the cable at any time, if the Council directs more lights to be located within the territory covered by the conduit.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING MAY 25, 1886.

342,320 Electric circuit wire insulator; Edwin C. Blake and Ernest C. Trimnell, Worcester, assignors by mesne assignments to said Blake and Trimnell, and George P. Hunt, Boston, Mass.

342,324 Insulating support for electric conducting wires; Alexander Brandon, New York, N. Y.

342,340 Electric signaling apparatus; Walter J. Dudley, Everett, Mass.

342,385 Secondary battery; Wm. H. Remington, Boston, Mass., assignor to Edward F. Hagar, same place, and Henry Sawyer, Chelsea, Mass.

342,407 Galvanic battery; Hugo Walter, Cincinnati, Ohio, assignor to the Walter Electric Company, same place.

342,441 Holder for commutator brushes; Charles D. Jenney, Indianapolis, Ind.

342,475 Electric current indicator; Frederic A. Swan, Everett, Mass.

342,477 Auxiliary mouthpiece for telephones; Norman A. Tanner, New Haven, Conn.

342,481 Circuit testing chronograph; James A. Tilden, Hyde Park, Mass.

342,495 Apparatus governed by electricity for flushing water-closets. Albert A. Barker, Worcester, Mass., assignor of one-half to Nathaniel G. Tucker & Son, same place.

342,499 Railway signaling; William C. Crandell, Philadelphia, Pa., assignor of one-half to Samuel D. Strohm, same place.

342,504 Magneto-electric and electro-magnetic machine; Rudolph Eickemeyer, Yonkers, N. Y.

342,508 Galvanic battery; Ernest M. Gardner, Brookline, Mass.

342,523 Compound electric cable; Hosea W. Libbey, Boston, Mass.

342,549 Electric lighting system; John H. R. Ward, Stoughton, Mass., and William J. Jenks, New York, N. Y., assignors to the New England Wiring Company, Boston, Mass.

342,552 System of electrical distribution; George Westinghouse, Jr., Pittsburgh, Pa.

342,553 Induction coil; George Westinghouse, Jr., Pittsburgh, Pa.

342,576 Telegraphic Relay; Sidney A. Chase, Evart, Mich., assignor of one-half to William R. Mapes, same place.

342,578 Manufacture of bichromate of soda; Wm. J. Chrystal, Glasgow, County of Lanark, Scotland.

BUSINESS NOTICE.

Dr. Van de Weyde, President of the N. Y. Electrical Society, inventor of various useful electrical devices, and author of a multitude of articles published in the electrical journals, and expert examiner of patents of this class, is open for an engagement as electrician of a company or enterprise where his theoretical and practical knowledge, aided by an experience of many years, especially with electro-motors, can find useful application. For reference see his biography in Johnstone's Cyclopedia. Call at the patent office of David A. Burr, Cooper Union, between 2 and 3 o'clock P. M., or address at residence, 236 Duffield street, Brooklyn, N. Y.

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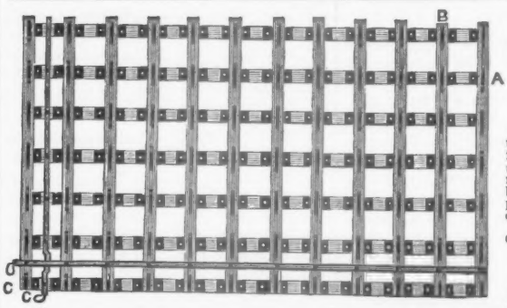

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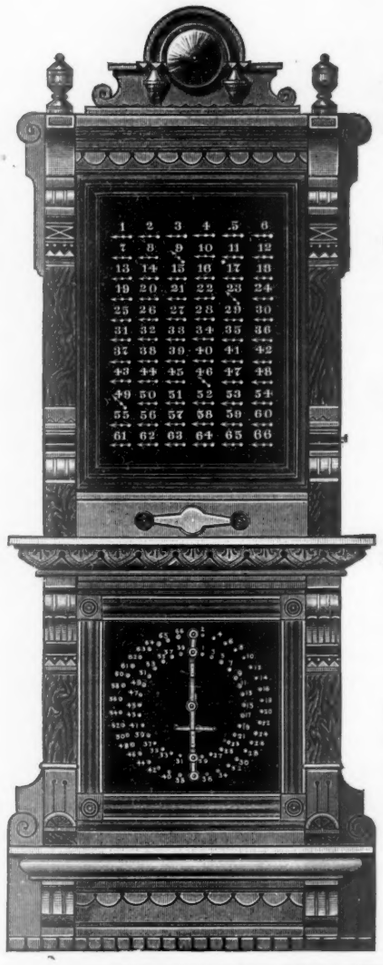

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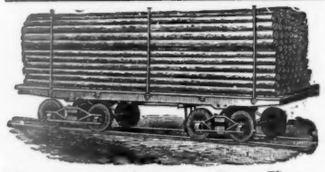

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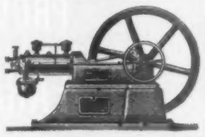

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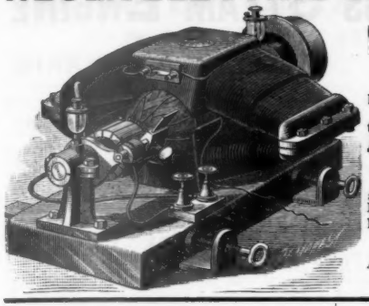

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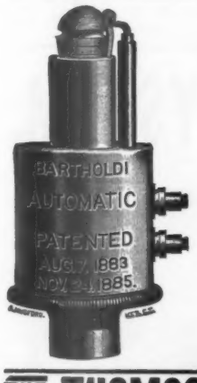

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8	⅛ "	3 00 " "	778 "
10	⅛ "	2 25 " "	1,175 "
12	⅛ and ¼ "	1 90 " "	7,236 "
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16	¼ "	1 00 " "	76,541 "
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19 (3 strands)	¼ "	1 20 " "	4,177 "
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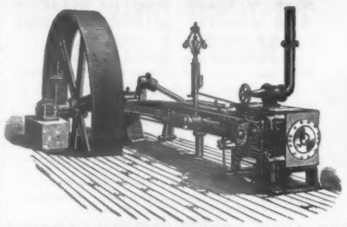

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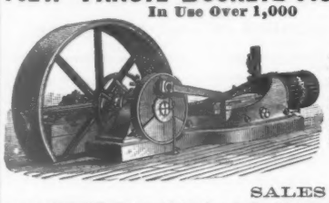

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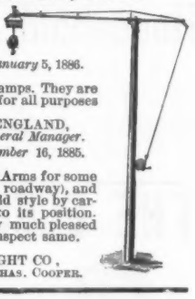

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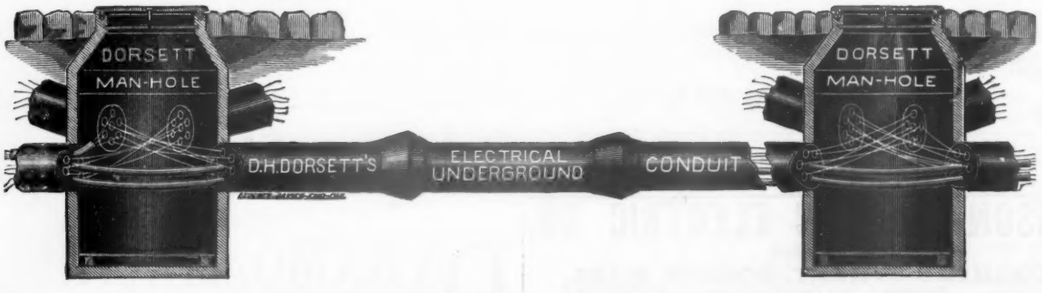

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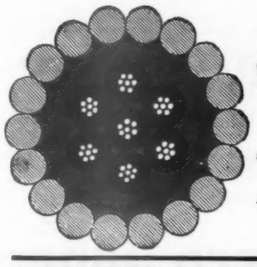

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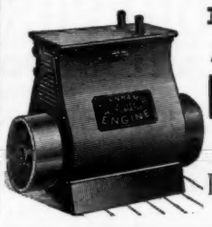

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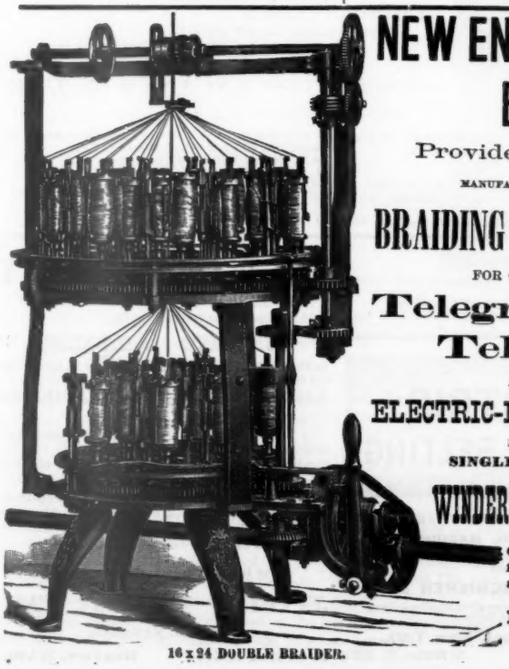

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